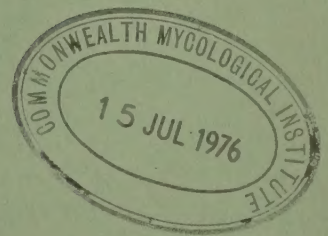
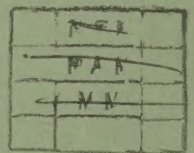


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ANNUAL REPORT

department of
agricultural technical services



1 july 1974 to 30 june 1975



REPUBLIC OF SOUTH AFRICA

ANNUAL REPORT

of the

**Secretary for
Agricultural Technical Services
for the period
1 July, 1974 to 30 June, 1975**

Published by Authority

Price R2,95

Abroad R3,70

Post Free

RP 43-1976

**Report of the Secretary for Agricultural
Technical Services for the period
1st July, 1974, to 30th June, 1975**

THE HONOURABLE THE MINISTER OF AGRICULTURE,
PRETORIA

SIR,

I have the honour to submit herewith the Annual Report of the Department.

W.A. VERBEEK
Secretary for Agricultural Technical Services

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1. Introduction

AGRICULTURAL EXTENSION

The agricultural industry is of a dynamic nature, especially in a country such as the Republic. Economic, sociological and technical factors constantly bring about - and even dictate - changes in agriculture.

It is the task of the extension service of the Department of Agricultural Technical Services to interpret and assimilate these changes all the time so that guidance may be given to farmers in the organisation and planning of the individual farming unit for agricultural development in general.

In recent years, much thought has been given throughout the world to the threat of famine, which is causing great concern. The essence of the problem is the production of sufficient food. And at the same time, the call goes out to the farmer to produce *more* - on the same area of land and in spite of a sharply rising cost structure.

Is this call from the millions who are not engaged in agriculture unfair and unrealistic? The answer is "yes", if the farmer does *not* receive the necessary extension that will enable him to apply the latest agricultural knowledge and production techniques, failing which the South African farmer cannot hope to answer the clarion call for greater and more efficient production.

What is the task of the Department's extension service in the production process?

TASK OF THE EXTENSION SERVICE

The primary task of the extension service is related to the overriding objective of the Department of Agricultural Technical Services, namely the achievement of optimum utilisation of resources on the individual farming unit.

The principles of optimum utilisation of resources are that agricultural production -

shall take place in harmony with the natural and physical conditions; shall not take place at the cost of agricultural resources; and shall be operated on an economic basis.

Arising from the foregoing, the more specific tasks of the extension service may be defined as follows:

1. To ensure that the agricultural resources are not overtaxed or destroyed. (The administration of the Soil Conservation Act, among other Acts, is basic to this task.)

2. To collect and interpret, with the assistance of researchers, data relating to the

natural and physical factors, namely soil, vegetation, topography and climate.

3. To assist researchers in determining physical and economic production norms for crops and animals within homogeneous farming areas.

4. To formulate adapted farming systems and practices within homogeneous production areas.

5. To convey agricultural information by means of modern extension methods and to persuade the largest number of farmers in the shortest possible time to apply adapted farming systems and practices in the individual farming enterprise.

The results achieved with the last-mentioned task will be decisive and will determine the degree of success attained with all the Department's inputs. The results of agricultural research must reach and be applied by those who need such information, otherwise the project which produced those results will not have served its purpose.

A fact that has to be reckoned with is that not all farmers immediately apply the knowledge and techniques imparted to them. Conveying new ideas, new knowledge and sophisticated techniques to a person and persuading him to apply them is a specialised task that makes high demands of the extension officers' communication skills and technical knowledge.

With this task description as background, one can get a better idea of the progress made in agricultural development.

AGRICULTURAL DEVELOPMENT AND OPTIMUM UTILISATION OF RESOURCES

By virtue of its direct contact with the farmer and with actual farming practices, the extension service is in the front line as far as the execution of the Department's policy is concerned.

In conjunction with the research institutes, the extension service therefore plays an important part in bringing agricultural development in particular homogeneous farming areas in line with the principles of optimum utilisation of resources. What follows below, serves as an illustration on the one hand of the successes already achieved and on the other hand of the scope and complexity of this task.

Overall co-ordination of extension activities throughout the country is ensured by 30 key programmes supported by 118 registered liaison

projects which, like research projects, are thoroughly planned. The following are a few examples of the nature and scope of these projects:

In the *Natal Region*, unique feeding simulators were developed by which extension officers are enabled to use these computerised models for carrying out feeding planning for meat and dairy herds on the farm.

In the *Transvaal Region*, the classification of an area of some 170 000 ha in seven target areas according to soil series has already progressed so far that this information is being used for the design of run-off control systems and the formulation of adapted farming systems and practices.

In the *Highveld Region*, an area of 191 692 ha, encompassing 419 farming units, has been fully divided into resource classes and plotted stereoscopically in units.

In the *Orange Free State Region*, a comprehensive series of projects are in progress which are designed to determine physical and economic production norms with a selected group of farmers. The establishment of these norms will be a break-through in this sphere of agricultural development.

Since 1972, the effect and importance of the Stock Reduction Scheme in the *Karoo Region* are being intensively evaluated by means of 16 liaison projects. The results of this investigation are set forth in the next Chapter of this report.

In the *Eastern Cape Region*, particularly good results were achieved with 19 liaison projects aimed at sound grazing management and utilisation. This drive was so successful that the percentage of farmers in the Molteno extension ward applying the recommended system has grown from 6 per cent to 30 per cent during the period 1972 - 1975.

In the *Winter Rainfall Region*, the technique of practice studies has been refined to such an extent during the past few years that these techniques can be used as a model in other regions.

In the development of a prosperous and self-reliant agricultural industry, it is essential that the human factor in man's socio-cultural environment also be taken into account. That is why the extension service must, apart from discharging its main task - namely the promotion of purposeful and systematic utilisation and conservation of the natural resources and hence also the full development of the agricultural potential of the Republic - at the same time try to promote the general welfare of the rural community.

The approach of the extension service is primarily of an educational or formative nature and is aimed at strengthening people's sense of responsibility and duty towards the community. The organisation and activities of study groups, programme planning committees and soil

conservation committees are logical consequences of this approach.

The operating methods and handling of study groups may be held up as an example of how committees are used in agricultural extension. At the moment, 281 study groups with a membership of 3 082 farmers are involved in extension activities.

STUDY GROUPS

Study groups serve as a valuable aid in the dissemination and establishment of sound farming practices among the members of the community. Apart from the exchange of information between individual members, the liaison of study groups with other farmers, especially through the medium of farmers' associations, is an effective way of communicating knowledge. The study groups' results and the recommendations arising from them are also often disseminated among the farming community by means of newsletters.

Through the diagnosis and rectification of shortcomings in the farming ventures of members of study groups good progress has already been made in turning farms into more economic and efficient units. The analyses of Regional Economists show that the members of study groups consistently achieve better results every year than they did the previous year. For instance, the figures for the Fort Brown Study Group in the Eastern Cape Region, which are considered to be fairly representative, serve as a good example of the progress being made in the economic sphere. With this study group, the net farming income per R100 of capital investment shows a steady rise from year to year.

This rise in net farming income is achieved in spite of the fact that the prices of agricultural requisites rose more sharply during the period in question than the prices of agricultural products.

The regular visits paid to study groups by the Regional Economist of the Division of Agricultural Production Economics of the Department of Agricultural Economics and Marketing, during which valuable guidance and assistance are given with the interpretation of economic analyses, play a major part in keeping enthusiasm at a high pitch.

AGRICULTURAL EXTENSION AND THE FUTURE

Extension research in the Western world shows that farmers may be classified in various categories according to the readiness with which they accept information. Numerous in-depth studies have for instance shown that the top 16 per cent of farmers enquire about and apply the latest agricultural information and techniques of their own accord. Farmers in this group turn to the agricultural expert for advice and, if need be, carry out their own experiments to test the applicability of information. These farmers do not need extension to make them aware of the latest

developments, nor do they need to be convinced afterwards.

The remaining 84 per cent of farmers react differently. World authorities such as Professors Leagans and Rogers of the USA and Professor Van den Ban of the Netherlands are agreed that the majority of farmers in this group have to be visited by extension officers, made aware of the latest knowledge and persuaded through specific communication techniques to apply that knowledge.

The well-known study of hybrid maize cultivation in the USA serves to illustrate this classification: it took most of the maize farmers in the USA 11 years to accept the obvious advantages of hybrid maize and to plant this maize. The top 16 per cent of farmers started trying out this new maize after only 1,6 years. It took most of the farmers in the 84 per cent group an average of 6,5 years before they began to try out the novelty (hybrid maize) on a small scale.

The challenge to the extension officer is to accelerate the process of acceptance. Part of his task is to persuade the largest number of farmers in the shortest possible space of time to adopt the latest agricultural knowledge and practices. This task is not a matter of passively supplying information on request.

If he is to succeed in his task, the first and foremost requirement for an extension officer is a thorough technical knowledge, because he must know what he has to tell the farmer. But, and herein lies the key to success, the task also requires the ability to put across the particular technical knowledge so skilfully and effectively that the farmer becomes interested in it, understands it, and eventually becomes sufficiently motivated to apply it. In this situation, the extension officer must have a thorough grasp of the dissemination and acceptance process, group dynamics and the art of communication in general.

In all the developed agricultural countries of the Western world, agricultural extension is looked upon as being a very important service and either occupies a prominent position in the Public Services of those countries or else is undertaken by Government-subsidised organisations.

As far as the RSA is concerned, the extension service of the Department of Agricultural Technical Services forms a very important part of the Departmental organisation. The functions performed by the extension service with regard to agricultural development are considered to be of special importance.

Agricultural scientists in South Africa are very scarce, and during the past decade the

accession from universities has either been static or has declined. But it is the agricultural extension service in particular that has been hard hit by the shortage of agricultural scientists. Not only is the accession of graduates to the service limited, but there is also a considerable drain of officers to the private sector.

In consequence, the Departmental extension service has been weakened to the point where the continued existence of the service is hanging in the balance.

During the past year, the Department of Agricultural Technical Services undertook several intensive investigations into the extension service, among which the following were the most important:

- The manpower position in the Departmental and other extension services, and the co-ordination of services.

- The organisation of Departmental extension services.

- Under-graduate and post-graduate training of extension officers.

- In-service training requirements.

- The demand for specialised extension.

The results of these investigations have again borne in on the Department the importance of a dynamic Departmental agricultural extension service. It is for this reason that the Department has come to the conclusion that the need for agricultural development in South Africa cannot be satisfied without a Departmental agricultural extension service, and that to this end -

- special measures should be introduced to obtain agricultural scientists for its extension service;

- adjustments should be made to the formal training of extension officers;

- a national co-ordinated in-service training programme should be instituted;

- a specialist extension service should be instituted with the primary task of technical support to extension officers;

- there should be better co-ordination between the extension services of the Department and those of other sectors; and

- the organisation of the extension service should be updated, wherever necessary, to fit in with changing conditions.

Purposeful agricultural research and a dynamic extension service are prerequisites if a sustained and rising food and agricultural production in South Africa is to be assured.

2. Extension and Education

AGRICULTURAL EXTENSION

Agricultural extension may be regarded as the line function of the Department of Agricultural Technical Services because the ultimate objective of the Department is to ensure that the latest available agricultural technical knowledge and innovations are applied by the majority of farmers.

The dynamics of agriculture and therefore extension activities are strikingly illustrated by the following new trends observed throughout the country during the year under review.

NEW TRENDS

Natal Region

The drop in the price of beef and the increase in the price of milk, with the accompanying increases in the cost of stock feed, fertiliser fuel, repairs and labour had a great influence on farming in this Region. The chief trends are as follows:

The switch from fresh milk production to beef production on artificial pastures largely came to an end, and increased interest in dairy production is evident.

The method of finishing beef cattle in feedlots is rapidly losing popularity. The present trend is to use pastures for this purpose.

The use of *Eragrostis curvula* for hay production has fallen off, and there is an increasing trend towards making silage from this grass. The inclusion of legumes in *Eragrostis curvula* pastures as a source of nitrogen is an important factor in this new trend.

There is more interest in artificial grass-clover pastures to cut concentrates and costs. There is at present greater interest in clover and lucerne because of the high fertiliser prices.

The extension of sugar-cane quotas resulted in more and more marginal and erosion-sensitive lands being used for sugar-cane cultivation.

There is an increasing demand, particularly in the coastal parts of Natal, for agricultural land which is then alienated for town development and other purposes.

The new borders of kwaZulu have, particularly in the Estcourt area, had a

far-reaching influence on the traditional extensive cattle farms in that the number of these "trek farms" is steadily decreasing. This means that farmers on the remaining smaller farms are obliged to intensify.

Transvaal Region

The greatest change that has taken place in farming is that dryland wheat is now being grown on the Springbok Flats during the winter. It is estimated that this year about 40 000 ha of wheat were planted, the yields varying from 20 to 40 metric bags (70 kg) per ha.

Extension activities as far as possible take the form of liaison projects. This is the first time that this method has been used in extension work in this Region.

The in-service training of specific officers and groups of officers received attention. This training was of a specific nature, for example, soil classification and planning of cattle farming, which are directly connected with the task of agricultural development within target areas.

Better evaluation in extension may be regarded as a new trend. Not only are the results of communication programmes in target areas scientifically analysed, but the system of quarterly reporting which was introduced during the year under review will put staff evaluation on a better basis in the future.

Highveld Region

The exploitation of agricultural land on a basis of differences in potential is at present a primary requirement in extension activities in this Region. During the year under review there was also a noticeable shift of emphasis from conservation to development. Extension programmes are based on this concept and the interest shown by the farming community has grown so much that various organised requests have been received for classification of soils on an area basis.

Free State Region

In the Bechuanaland Subregion there was a very strong tendency this season to intensify crop production as far as possible, particularly by mechanising.

A trend away from groundnuts has also



A short course in artificial insemination at the Glen Agricultural College

become evident, but it is expected to be only of a temporary nature lasting until the problems with, in particular, mechanisation and diseases (*leaf spot and blotch*) are solved.

Karoo Region

As a result of veld improvement and particularly the increase in annual and perennial grasses after the unusually good rains of the past two years, there is great interest in the inclusion of beef cattle in the normal farming pattern.

A Queenstown dairy is at present negotiating with farmers' organisations about the purchase, transportation and collection of fresh milk on the important main routes - which raises the possibility that dairy cattle will play an increasingly important role in future.

In the Fish River Valley vegetable production has expanded enormously. Farmers cultivate nearly all types of vegetables, but particularly green beans and sweetcorn on contract for canning factories.

A number of farmers are trying to introduce cash crops that are new to the area, such as tobacco and olives, in their irrigation farming.

Eastern Cape Region

Farmers are becoming more conservation-minded and a growing number of them are adopting a positive approach to optimal resource utilisation. It is learnt from the extension wards of Alexandria, Dordrecht, Elliot and Barkly East that artificial pastures and perennial forage crops are replacing cash crops on a large scale.

The very favourable beef prices have caused a shift in the direction of beef cattle farming.

It also appears that there is greater interest in study groups, evidently because farmers are taking an increasing interest in the financial aspects of their enterprises.

Younger farmers are figuring more and more as campaigners for soil conservation. Some of them have good educational qualifications and some even university training.

Winter Rainfall Region

Because of the rising production costs of wheat and the unfavourable long-term rain pattern for small grain, the livestock enterprise is receiving increasing attention in the South Coast Subregion. There is also a gradual trend away from the Merino to the more intensive breeds such as the SA Mutton Merino and Dormer.



Farmers of the Outjo district, South West Africa, attend a pasture course

In the Swartland Subregion the trend towards meat production is more marked. In particular, there is great interest in the early weaning of lambs with a view to three lambing seasons in two years.

Regional development as a method of work for extension officers was introduced in this Region during the year under review. With this well-ordered system the impact of the extension service should be further increased.

Cooperation with extension officers from the private sector was also carried a stage further by the establishment of a third extension liaison committee for the Paarl and Stellenbosch extension wards.

South-West Africa Region

There is a breakaway from individual extension with the emphasis on group extension to small groups of farmers who get together on the farms of farmers who do not normally attend meetings of farmers' associations. Such gatherings provide an opportunity for mini farmers' days on farmers' land. Quarterly newsletters from the extension officers have created a cheap but effective channel of communication which is being expanded further.

Farming competitions are still increasing and are a very effective means of getting farmers to accept new practices.

PROGRESS IN PROGRAMME PLANNING

Programme planning and associated planned activities to bring about agricultural development in all spheres may be regarded as the main task of the

extension service.

The scope of these activities will only be indicated in broad outline below, a few examples of programmes in each of the eight regions being given.

Natal Region

The following two programmes illustrate the nature of programmed extension in this Region:

Title: The promotion and economic intensification of beef production in Bioclimatic Group 4 in the Underberg Soil Conservation District.

Aim: To plan the fodder requirements of all livestock of 100 cattle farmers in the Underberg Soil Conservation District and to provide each of them with a feed budget programme within five years with a view to raising beef production in this area by at least 50 per cent.

Results: Eighteen of the target number of 20 farmers were visited and feed programmes drawn up. In addition, 164 soil samples and 76 stock feed samples were taken. According to estimates, 75 per cent success was achieved with the short-term working plan.

Title: The promotion and economic intensification of beef production in the Swartberg part of Griqualand East in Bioclimatic Groups 4F and 4E.

Aim: To raise by 10 per cent the calving percentage and weaning weight of the cattle herds of 28 farmers in the Swartberg part of the Mt Currie Soil Conservation District.

Results: Four of the target number of seven farmers in the short-term programme were visited individually, and the following was done:

A questionnaire was completed for each farmer and information about the beef

SUIDWES-AFRIKA SOUTH WEST AFRICA

- 
 Hoofkantoor en
Substreekkantoor/
Head Office and
Subregional Office
- 
 Landboukollege/
College of Agriculture
- 
 Navorsingsstasie/
Experimental Station
- 
 Voorligtingskantoor/
Extension Office
- 
 Substreekkantoor/
Subregional Office



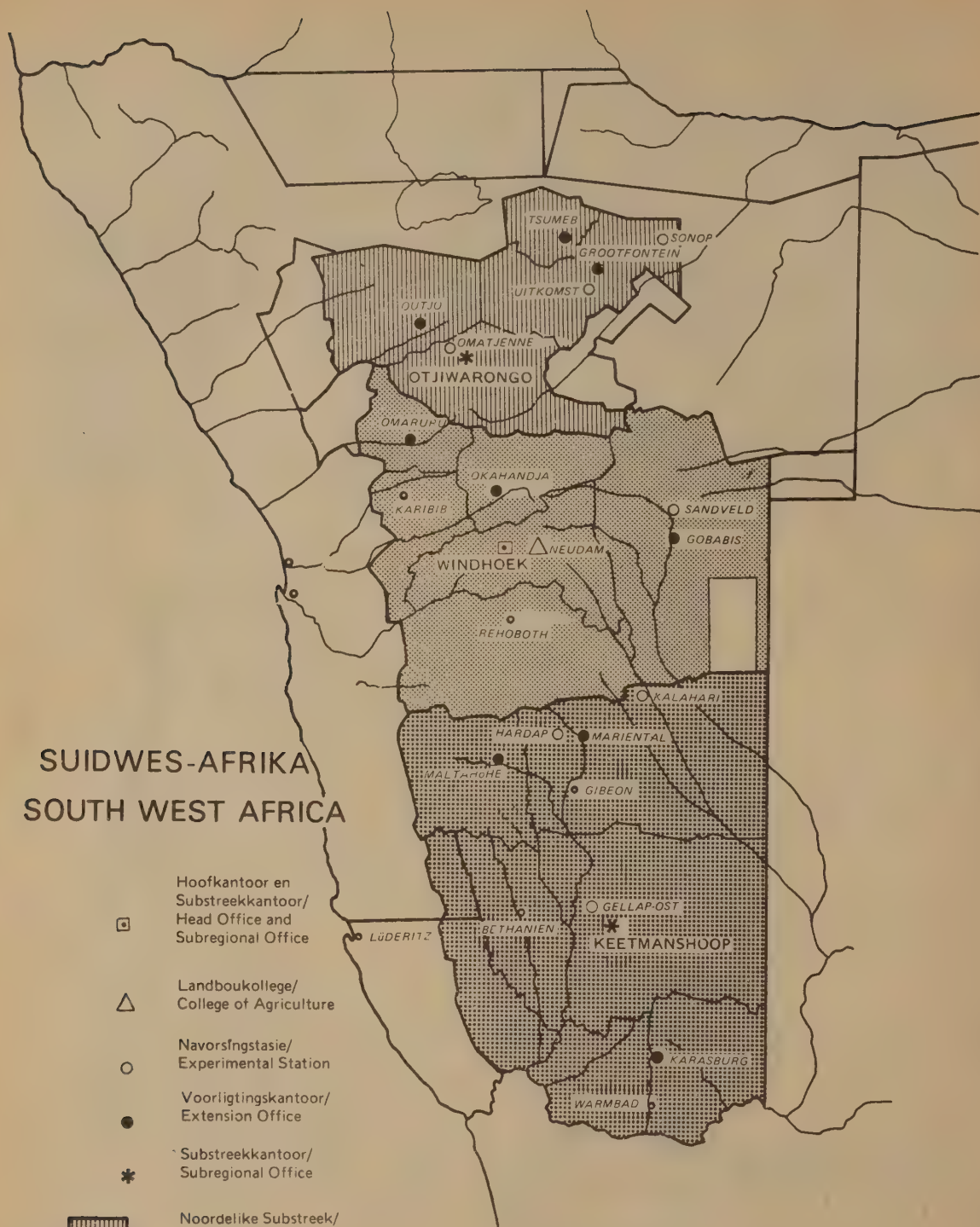
Noordelike Substreek/
Northern Subregion



Sentrale Substreek/
Central Subregion



Suidelike Substreek/
Southern Subregion



systems applied was gathered and extension provided.

A feed budget was drawn up and the requirements of the beef herds determined.

Soil maps for each of the farms were prepared by local technicians.

Soil samples of all lands were taken.

Rational crop and fertilisation programmes were worked out for each farmer, based on the soil maps and soil analyses.

Farmers' stored feeds were analysed. These analyses were discussed with the farmers and recommendations made about supplementary feeds.

Apart from the above examples, five other programmes were finally registered during the year under review concerning fresh milk production, maize production and soil conservation.

Transvaal Region

During the year under review 22 liaison projects were registered. Of these liaison projects 10 concern the formulation of adapted farming systems and 12 concern the design of a water run-off control system.

Two liaison projects that may be regarded as purely communication projects have been submitted for registration.

With a view to executing these projects the following areas of land in target areas were classified:

Target area	Area (ha)
Eerstegoud	32 000
Bokpoort	52 000
Laer Watervals	20 000
Kafferspruit	30 000
Wolwekraal	2 000
	136 000

Soil maps for these areas are being completed.

Highveld Region

The progress of programmes in this Region may be summarised as follows:

Classification of resources in the first seven development areas, which was started in November 1973, was completed during the year under review.

The 14 areas in which resource classification is being done under the Regional Development Programme cover a total area of 191 692 ha and include 419 farm units.

The total area has already been stereoscopically classified on contact aerial photographs into mapping units.

An intensive field control of the stereoscopic classification was completed on 90 per cent of the total area.

Full profile descriptions and sampling were completed in 75 per cent of the total area.

The final determination of soil-type boundaries with descriptive symbols and full codification of all veld data was completed for 54 per cent of the total area.

Free State Region

The following report on a specific project is a typical example of progress in programme planning in this Region:

Vaalharts

Aim: To increase the irrigation efficiency in the Vaalharts irrigation area.

The more specific objectives of this project are as follows:

(i) To change farmers' and soil conservation committee members' present outlook on the rehabilitation of waterlogged and brackish soil so as to bring it in line with the views of the Departmental officials.

(ii) The physical planning of at least 50 farms in respect of field lengths, directions of irrigation and slope.

Results: The results obtained are certainly the outstanding achievement in this Subregion.

The members of the soil conservation committee were taught the causes and consequences of waterlogged soils, with supplementary demonstrations on how the irrigation land can be rehabilitated. These activities changed the farmers' outlook and encouraged them to take positive action.

A farmers' day with internal drainage as the theme also helped change the existing outlook. Consequently, eight plots were fully drained during the year under review and 52 farmers are now constructing internal drainage systems on their irrigation farms.

During the year under review the physical planning of 81 farms was done, which considerably increases the efficiency of irrigation on the individual farms.

The local soil conservation committee of 13 members liaised between the Extension Office and the public.

Karoo Region

In this Region the liaison projects fall under three subheadings, namely Farm Enterprise Development, Agricultural Resource Development, and Community Development.

The following results are given to illustrate the progress of 16 projects under the subheading Farm Enterprise Development:

Projects that have been under way since 1972 already and in which particularly good results have been achieved deal with the *evaluation of the influence of participation in the Stock Reduction Scheme on the veld*. Such projects were launched in each of the 16 field offices.

In Table 1 a short summary is given of the findings in the 16 projects. Because of lack of space a comparison is drawn only between the basal-cover percentage of the main plant



Young farmers at a short course in wool classing at the Grootfontein Agricultural College

components, namely grasses and bush, and the total basal cover. Full details of the increase or decrease in the percentage of vegetal cover is given in progress reports.

From the information in Table 1 it appears that there is considerable variation in the plant composition and percentage cover in the 16 extension wards. However, there is also a marked fluctuation from one survey to the next. A persistent trend revealed by these surveys is that from 1972 to 1973 there was a drop in the basal-cover percentage in 10 of the 16 extension wards. In all probability this drop was due mainly to the very poor summer season of 1972/73.

With the exception of four extension wards the surveys in 1974, however, showed a considerable increase again in the basal-cover percentage which coincided with an exceptionally favourable rainy season in the summer of 1973/74. With the favourable climatic conditions lasting until late in the summer of 1975, the basal-cover percentage of the few extension wards for which information is already available improved further.

In spite of the strong influence that climate had on the decrease or increase in the basal-cover percentage, it appears that of the 15 wards for which full particulars are available there were only *four* in which the average basal-cover percentage did not increase during the three years of the survey.

A further analysis of results also shows the following:

It appears that with a few exceptions, non-participating farmers, kept fewer stock than their permissible numbers. In fact, this emerged all the more clearly as the results of the Stock Reduction Scheme became known. One gains the impression that in all cases the conditions of the Stock Reduction Scheme are complied with by a large percentage of non-participating farmers.

Comparison of the average gross income of participants with that of non-participants shows that participants earned a higher income per small stock unit in most of the extension wards during the 1972/73 and 1973/74 financial years.

With the exception of at most two extension wards, the participants' average gross income per small stock unit for 1973/74 was also higher than that for 1972/73 and in seven wards non-participants showed a drop in average income per small stock unit from 1972/73 to 1973/74.

Eastern Cape Region

In this Region red meat production and veld improvement are stressed in most extension programmes.

The following two programmes illustrate what is achieved with such programmes.

A comparison between the basal-cover percentage of the main veld components on farms of participants in the Stock Reduction Scheme in 16 extension wards in the Karoo Region (1972-75)

	Basal-cover percentage											
	1972			1973			1974			1975		
	Grass	Bush	Total	Grass	Bush	Total	Grass	Bush	Total	Grass	Bush	Total
Cradock	1,30	1,70	3,10	1,40	0,90	2,50	2,50	1,10	3,60	-	-	-
Graaff-Reinet	4,58	1,42	6,14	5,59	1,04	6,76	4,53	1,24	5,96	-	-	-
Jansenville	0,20	1,47	1,93	0,33	0,99	1,51	0,83	1,64	2,82	0,82	1,94	3,12
Somerset-East	0,19	0,57	0,78	0,49	0,83	1,33	1,80	1,15	3,01	-	-	-
Burgersdorp	4,38	0,10	4,48	3,34	0,14	3,48	5,29	0,12	5,41	-	-	-
Colesberg	0,88	2,11	3,29	0,38	1,76	2,17	1,09	1,27	2,40	-	-	-
De Aar	2,10	1,96	5,04	2,21	1,64	4,38	4,84	2,28	8,15	5,00	2,32	7,65
Middelburg	-	-	-	-	-	-	1,58	1,15	2,89	3,30	1,13	4,58
Calvinia	0,48	0,55	1,55	0,67	0,59	1,69	0,63	0,85	1,93	-	-	-
Carnarvon	0,35	1,22	1,70	0,14	0,42	0,61	0,28	0,32	0,63	-	-	-
Kenhardt	0,62	0,25	0,93	0,07	0,16	0,93	1,52	0,27	1,96	1,43	1,42	1,70
Prieska	2,88	2,02	5,15	3,04	1,04	4,21	5,04	1,58	7,01	-	-	-
Beaufort-West	0,95	3,02	4,36	1,56	2,42	4,35	3,14	2,19	5,68	-	-	-
Fraserburg	0,10	1,59	1,72	0,14	0,54	0,68	0,34	0,56	0,93	-	-	-
Laingsburg	0,14	1,34	1,85	0,36	1,49	2,18	0,43	1,52	2,35	0,20	0,70	0,95
Victoria-West	2,33	3,24	6,08	3,99	3,06	9,28	7,41	4,46	12,87	4,16	2,66	7,23

Aliwal North

The purpose of the programme is to increase the red meat production of members of the Red Meat Club over a five-year period from 8,5 kg per ha in 1974 to 13,5 kg slaughtered mass per ha in 1979. It is also expected that, as a result of the ripple effect spreading from these leading farmers, production in general will rise during a 10-year period from 5,8 kg to 9,8 kg per ha.

This programme is being implemented in the closest cooperation with Organised Agriculture and only full members of Organised Agriculture are admitted to the Club.

Progress

An inventory was prepared covering numbers, age and live mass of all stock belonging to the 21 club members. A system of records of sales, purchases, deaths, and so on, was used and after a year stock was taken again and an inventory prepared.

From the analysis of this information it was established that during the past year the members produced 9,5 kg slaughtered mass of red meat per ha. The extension inputs in the programme were three farmers' days, four lectures to study groups, and about 30 visits to farmers.

Other wards in the Region are also trying to increase red meat production and programmes may later be registered. Red meat farmers' days were held at Molteno and Dohne to propagate this idea.

Molteno

The programme in the Molteno Extension Ward is one of 19 other liaison projects falling under the key programme for veld improvement and utilisation. The general objective of this key programme is sound grazing management.

(i) Nine of the liaison programmes are aimed at achieving this by the application of recognised

rotational grazing and resting of the veld. Some of these programmes are also aimed at achieving the desired stocking rate and/or large stock:small stock ratio.

The following table shows the progress with the group-camp system in the Molteno Extension Ward.

Percentage of farmers in the Molteno Extension Ward using the group-camp system from July 1972 to July 1975

1972	1973	1974	1975
6%	12,5%	25%	30%

The table shows that the target of 25 per cent has already been achieved and that 30 per cent of the farmers are applying the group-camp system worked out by the Extension Officer.

The success of this programme may be ascribed mainly to the fact that the personal contact made by the farmers themselves was followed up by the Extension Office.

It is particularly gratifying that the farmers look upon veld reclamation and improvement as a matter of applying a good grazing system and all that goes with it.

In the Molteno Extension Ward the veld resting programme is also going very well and the farmers are resting a good deal more than 25 per cent of their veld as laid down by the programme. The following table illustrates this:

The percentage of grazing rested for at least six consecutive summer months between September and March in the Molteno Extension Ward from 1970 to 1975

1970/71	1971/72	1972/73	1973/74	1974/75
39%	38%	35%	47,4%	43,5%

Another pleasing fact is that 63 per cent of the farmers have a rotational resting programme for their grazing. In other words, the camps that are rested are not the same every year. The progress and success in this aspect of veld management may be ascribed mainly to the programme for the promotion of the group-camp system.

A further striking feature is that the farms on which good grazing management is applied are very clearly and easily distinguishable. In spite of the rather unfavourable late summer these farmers' veld showed no ill-effects, whereas other farmers were already beginning to complain of drought.

Winter Rainfall Region

Of the 51 programmes in this Region 17 concern production efficiency and 33 soil conservation aspects. The remaining programme concerns the identification of farmers' needs and problems.

That the extension officer is constantly involved in research at the farm level, in consultation with research colleagues, is evident from the following programme:

Vredendal

The following aspects of viticultural practices are receiving attention in this programme:

(a) Varieties

An interplanting trial was laid out during September 1974 in collaboration with the KWV and the Oenological and Viticultural Research Institute on a farm in the Klawer area to find suitable good wine grape varieties for this Region. Sixteen white and 12 red wine varieties were included in the trial to evaluate them for their adaptability as reflected in vigour, yield and wine quality under the prevailing climatic conditions on the main soil type of the area.

The percentage take was very good, and only about 2 per cent of the vines were lost.

(b) Flood irrigation

Trials were undertaken during the year under review in order to evaluate the present check irrigation system on the Olifants River Irrigation Scheme, to detect faults, and to propose improvements in order to ensure efficient water utilisation. Infiltration measurements and flow gaugings were taken and other illuminating preliminary data were gathered:

(i) Applications are generally too high; in other words, more water is used than the soil can retain to the prevailing root depth. This faulty practice may be ascribed largely to undersized irrigation furrows.

(ii) Uneven applications as a result of uneven check slopes and irrigation flows that are cut off too late are common malpractices.

(iii) Uneven infiltration occurs, the result being a faulty ratio between slope and infiltration

rate, which in turn results in the loss of large quantities of water that should have infiltrated.

(iv) The use of a cover crop on sandy soils prevents erosion, making it possible to use a stronger irrigation flow and consequently to achieve a better optimum water application.

Whereas the programme described above is at this stage aimed at identifying problems and malpractices, the following programme is a good example of a typical persuasion campaign:

Ladismith

The short-term objectives of this programme are, within one year:

(i) to persuade 10 farmers to prepare soil thoroughly with regard to soil depth, compaction and weed control;

(ii) to persuade 50 per cent of the producers who decide to establish vineyards to grow cultivars such as Steen, Colombar and Hanepoot for good wine; and

(iii) to persuade 50 per cent of the producers who decide to establish vineyards to use the correct spacing with a view to mechanisation and trellising.

An evaluation showed that out of the 40 farmers who *established vineyards during the past three years* the following numbers did apply the various recommended practices:

Practice	No. of farmers	Percentage
Soil broken and ploughed deep	34	85
Quick-grass control	33	82
Recommended cultivars planted	33	82
Correct spacing	35	87
Multiple-strand training system	29	73

From the above information it is clear that the objective of annually persuading 50 per cent of the producers establishing vineyards to apply the desired practices was achieved.

South-West Africa Region

Progress with programmes may be summed up as follows:

Programme planning and progress with programmes: Almost without exception soil conservation committees

In the Northern Subregion the four previous three-year programmes were completed, and a survey showed that the objectives were achieved.

New programmes which are more production-oriented were drawn up for the following three-year period.

An evaluation of the four previous ward programmes showed that the number of farmers following a good veld management system had risen from 10 per cent to 28 per cent and that the number of camps per farm unit had increased from 15 to 21. Stock numbers decreased by 25 per cent during the corresponding period.

All extension wards are at present

engaged on the delimitation of areas and the determination of potential with a view to preparing a Regional Programme.

STUDY GROUPS AND PLANNING COMMITTEES

Study groups and planning committees are elected from among the farmers and are a valuable aid to the extension officer in putting a programme into practice.

The extent to which use is made of these committees in the Regions is outlined briefly below.

Natal Region

The Director of this Region points out that the valuable contribution made by study groups in the Natal Region during the year under review as an extension medium and a source of information cannot be stressed enough. There are 35 active study groups with a membership of 605 in the Region. During the year under review 136 meetings and gatherings were held.

The following matters received attention from these study groups:

- Mail-in records, beef production
- Maize production
- Vegetable production
- Protection of sugar-cane fields
- Dairying
- Pastures
- Banana production
- Land use

The soil conservation committees in the Natal Region play an important role as programme planning committees. At present 14 committees are active in this field with a total membership of 82 involved in agricultural development.

Progress with the proposed objectives of these programme planning committees in the Region was as follows:

Eighty eight per cent of the proposed short-term objectives of the four beef production programmes was achieved. A fifth beef production programme was prepared for approval in principle.

Seventy five per cent of the proposed short-term objectives of the one fresh milk production programme was achieved. The silage production had already been increased by 50 per cent after one year, and the milk production of the dairy cows of participants in the programme was already up 50 per cent.

Forty per cent of the proposed short-term objectives of one maize production programme has already been achieved and a second maize production programme has been prepared for approval in principle.

Forty two per cent of the area of the proposed first programme areas has already been surveyed in the contour programme.

Hundred per cent of the target number of Indian farmers in the short-term

bench-terrace programme were enlisted and 3 670 metres of terraces were built and planted with pineapples. Indian vegetable farmers in the Clifffdale area formed a farmers' planning committee so as to introduce the bench-terrace programme there as well.

Transvaal Region

According to all subregional reports, it is striking that more and more farmers are interested in joining one study group or another. That farmers are in earnest about this extension medium is clear from the following reports.

Pietersburg fresh milk producers established a fresh milk producers' study group in collaboration with the extension officer. The first task of this study group is to study the economic planning of a dairy. For this purpose participation in the mail-in record scheme of the Division of Agricultural Production Economics was obtained.

A second study group was established in the Marken area in co-operation with the technical officers of the Vleissentraal. The main purpose of this study group is to study increased red meat production under extensive conditions. The purpose of the study group now coincides with the main purpose of the communication programme in the Koedoesrand target area and activities will also be coordinated to fit in with the communication programme.

A study group of eight members was recently established in the Levubu area. The main purpose of this group is to study all aspects of the soils in the vicinity of Levubu.

In the Central Transvaal Subregion the number of study groups dropped from 10 to 6, but the number of gatherings - 40 as against 35 in the previous year - shows that there is still keen interest in study groups.

In the South-Eastern Transvaal Subregion the Davel study group again did very valuable work in the form of a thorough analysis of production costs in maize cultivation.

Highveld Region

During the year under review 23 study groups were active in the Region. They had a combined membership of 425 and held an average of five meetings per study group. The various subjects studied are shown in the following table.

Field of study	Number of groups	Number of members	Number of meetings held
Field husbandry	9	118	24
Mail-in records	6	104	29
General production studies	4	160	38
Red meat production	2	18	9
Milk production	1	14	12
Grazing	1	11	2
Total	23	425	114

Once again the value of study groups must be stressed as a valuable medium of extension, a means of setting standards and a means of testing extension recommendations through co-operative and demonstration trials.

The Ficksburg Study Group

During the year under review the membership of the Ficksburg Study Group rose from 30 to 90. The study group normally meets monthly, but in order to handle a heavy programme of work 41 meetings were held during the year under review. Some of the subjects dealt with were:

- Tractor costs
- Nitrogen requirements of winter wheat
- Artificial pastures
- Estate planning
- Fattening of cattle
- Forestry possibilities in the Ficksburg district
- Nitrogen requirements of *Eragrostis curvula*
- Grazing management
- Management of labour
- Maize cultivation
- Raising calves

The study group also arranged a four-day tour for a party of 45 farmers. Highlights of the tour were the party's visits to the Cedara College of Agriculture and the fattening trials of a firm of auctioneers.

Free State Region

The study groups (with subjects) active in this Region are shown in the table below:

Study groups			
Type	Number	Number of members	Number of meetings
Mail-in records	5	60	12
Pasture	1	14	11
Crop production	1	7	4
Total	7	81	27

The level at which study groups function is clearly reflected in the following two tables relating to the Olifantshoek Study Group and the Postmasburg Study Group, respectively.

Olifantshoek Study Group

The average annual figures for the main efficiency criteria of the Olifantshoek Study Group for the five years ended 28 February 1975 are as follows:

Criterion	1970/71	1971/72	1972/73	1973/74	1974/75
Net farm income per R100 of capital investment	R3,09	R6,73	R6,10	R8,68	R9,87
Net farm income per ha	R0,81	R1,98	R1,65	R2,29	R3,30
Gross farm income per ha	R2,23	R3,17	R2,96	R3,58	R4,74

As is evident from the table, the incomes per R100 of capital investment and per hectare increased a great deal. The improvement in the rainfall since 1971 and the increase in product prices undoubtedly played a part in this.

Postmasburg Study Group

An important finding of the Postmasburg Study Group, based on observations during the past three years, is that heavy stocking rates on the veld do not produce better results than a light rate.

The following table shows the results obtained by members with different stocking rates:

Results obtained by members of the Postmasburg Study Group with different stocking rates for the 1973/74 financial year

Groups of members according to level of stocking	Average net farm income per R100 of capital investment			Average stocking rate ha/LSU		
	1971/72	1972/73	1973/74	1971/72	1972/73	1973/74
Lightest one-third	R7,18	R 7,43	R9,25	19,54	20,29	20,16
Middle one-third	R7,96	R10,13	R3,95	12,33	16,48	12,46
Heaviest one-third	R7,03	R 7,18	R5,62	10,59	9,98	9,22

It is clear from the table that members with a light stocking rate during the past three years - which were favourable years - fared better than those with a heavy rate. In dry years those who maintain a light stocking rate will still obtain far better results than those with a heavy rate.

Karoo Region

The 34 study groups with a combined membership of 255 held 94 meetings with an attendance of more than 80 per cent.

Of the 34 groups, 22 are investigating the economics of farming and very reliable information is gathered through the mail-in record system and analysed annually by the regional economist. Report-back meetings are held from time to time at which the processed data are discussed in detail with the groups.

The fields of study of the remaining groups are grazing management, establishment of drought-resistant forage crops, veld improvement, lambing and weaning practices, mating methods, and fattening.

The Waterford Economic Study Group, for example, after analysis of the first year's data, found that far more attention would have to be devoted to the following aspects of their farm enterprises:

- (i) Increasing the lambing percentage.
- (ii) The most economic flock composition.
- (iii) Efficient labour utilisation.

The Winterhoek Veld Improvement Study Group is still functioning very well and undertook a series of very useful investigations and discussions in the following fields:

- (i) Identification of plant species and objective evaluation of the veld.
- (ii) A demonstration on the reclamation of bare patches.
- (iii) Discussion of veld management practices, mating practices, economics and various stock breeds, main stock diseases, and plant surveys.
- (iv) Slide shows on veld improvement.
- (v) Film shows on fodder banks.

Eastern Cape Region

The number of study groups in the Eastern Cape Region increased by two during the past year. There are now 23 study groups in this Region with a membership of 269. This represents an increase of 49 members, or 22 per cent, over the past year. The following table illustrates the degree of activity of the study groups.

The degree of activity of study groups in the Eastern Cape Region during the years 1973/74 and 1974/75

Degree of activity	1973/74		1974/75	
	Number	%	Number	%
Very active	6	28.6	11	47.8
Active	12	57.2	11	47.8
Inactive	3	14.3	1	4.4

From the table it is clear that there was a 19.2 per cent increase in the number of very active study groups during the past year. As against this, the number of active and inactive study groups dropped by 9.4 per cent and 9.9 per cent, respectively.

This improvement in the study group activities can probably be ascribed to the upward spiral of costs and the fact that farmers are realising the value of study groups in fighting the cost squeeze.

Winter Rainfall Region

The following table shows the number of study groups functioning in the Region during the past two years as against the number of members.

Study groups in the Winter Rainfall Region, 1973/74 - 1974/75

Subregion	1973/74	Member-ship	1974/75	Member-ship
				Nort
Swartland	4	33	5	45
Boland	9	109	11	121
Little Karoo	18	307	14	211
South Coast	5	41	7	66
	10	98	12	124
Total	46	588	49	567

The table shows that the number of study groups increased by three, but that the number of members decreased by 21, mainly because of the drop of 96 in the membership of the study groups in the Boland Subregion.

The farm enterprises covered by these study groups are the most important in the Region and include wine grape, table grape, fruit, wheat and oriental tobacco cultivation. Other aspects covered are dairying, stock breeding, citrus, nurseries, vegetables, dried fruit and drought-resistant forage crops. The mail-in record study groups are very active and gather valuable economic data.

South West Africa Region

In the Northern Subregion the four soil conservation committees act as an umbrella committee for programme planning and plan all educational activities in the various wards for the achievement of specific objectives. Mail-in record study groups increased to six during the past year and their findings are already beginning to bear fruit.

Good results are also obtained in the Central Subregion through study groups for the following subjects:

(s) Establishment of climax grasses in the veld by planting cuttings in the veld and sowing clay-pelleted grass seed.

(ii) The improvement of veld grazing by the correct inclusion of the Boer goat.

(iii) The improvement of puddled veld by ploughed furrows and the intersowing of grasses.

(iv) Veld improvement by the application of various grazing systems.

(v) Increasing calving and lambing percentages.

(vi) Record-keeping and evaluation of veld grazing.

(vii) Determination of meat production per hectare.

(viii) Determination of lick intake with various grazing systems.

CONSERVATION FARMING COMPETITIONS

In the Natal Region conservation farming competitions play an important part in keeping alive the interest in soil conservation.

During the year under review there were 25 farming competitions with 142 participants. In Northern Natal three conservation farming competitions were held in which 21 people competed. Two farmers' days were held on the winning farms and great interest was shown in three maize yield competitions which drew a total of 43 entries.

In the Transvaal Region two competitions were held, in the Free State Region one, and in the Karoo Region three.

In the Eastern Cape Region six very successful conservation competitions were held. Nearly 180 farmers were involved after the competitions at farmers' days held on the winners' farms.

In the Winter Rainfall Region eight competitions were held which undoubtedly helped keep farmer's interested in the preservation of natural resources.

In the South West Africa Region fourteen conservation farming competitions were held which were characterised throughout by great interest and enthusiasm on the part of the farmers. Three farmers received Master Conservation Farmer awards and various one and two star awards were made to other participants.

EXTENSION RESEARCH AND SURVEY

The scope and content of survey research in each of the eight regions will be discussed briefly.

Natal Region

The development of the Natal beef and dairy feeding simulator progressed so well during the year under review that the Region's extension officers are now using these computerised facilities for feed planning for beef cattle and dairy cattle in the veld.

The resource potential survey progressed to the point where 20 per cent of the Region has been surveyed.

During the year under review the brack problem at the Mkuze Irrigation Scheme was investigated and a report on the adaptation of certain Australian irrigation techniques in Griqualand East was completed.

Transvaal Region

Four comprehensive situation determinations were undertaken in which 246 farmers in four target areas were involved.

A maintenance schedule in respect of groundnut cultivation was formulated and tested. It is the latest addition to the existing six maintenance schedules.

The use of standardised questionnaires and computer programmes has meant that the drudgery or survey research is now a thing of the past and much time is saved.

Highveld Region

Two interesting investigations undertaken in this Region concern dry bean yields and economic criteria in a part of the Region where field cropping is the main enterprise.

Dry bean yield studies

In collaboration with the extension officers stationed at Delmas and Bethal and farmers who had kept written records, 51 studies were undertaken. As in the case of other grain crops for which yield formulas are available, consistent ratios between the calculated yield and the yield obtained in practice emerged. These ratios are known as the realisation percentage, which, in a nutshell, means that the yield obtained is expressed as a percentage of the calculated yield. Summarised results of the yield studies are shown in the following table.

Type of bean	Realisation percentage	Length of growing season (days)
Kidney	87,8	120+
Coffee	64,1	110+
Haricot	62,9	110
Sugar	50,9	110
Michigan	47,4	100

A few criteria from the South-Western Transvaal

In the South-Western Transvaal the following averages were found during the favourable 1973/74 production year:

Size of farm unit:	885 ha (67 per cent cultivated)
Gross farm income:	R90 483 (crops 83 per cent, livestock 14 per cent, other 3 per cent)
Farm expenses:	R44 431 (equipment 30,8 per cent, labour 27,2 per cent, fertiliser 15,8 per cent, feed 9,1 per cent, other 17,1 per cent)
Net farm income:	R45 957
NFI per R100 of capital investment:	R19,96
Gross production value per ha, maize:	154,67 (3 020 kg/ha)
Gross production value per ha, groundnuts:	R243,73 (1 300 kg/ha)
Gross production value per ha, sunflowers:	R121,50 (1 080 kg/ha)
Gross production value per LSU, dairying:	R113,26

Free State Region

One of the surveys made in this Region produced remarkable insights into the present situation in respect of farm planning.

The scope of this survey is reflected in the following table. Additional information is given to supplement the table.

Molopo Soil Conservation District: 30.6.75
Size: 1 283 516 ha (White-owned land only)
Area planned: 1 123 593 ha (87,5 per cent of total size)
Number of farm units planned: 386 - plans fully executed for 173 (44,8 per cent) of these units.

Frequency distribution of the number of camps per farm unit in the conservation area

Number of camps	0-5	6-11	12-15	16-20	21-25	26-30	31-36	36 and over
Number of units	29	133	86	52	22	24	17	23
% of total (386)	7,5%	34,5%	22,2%	13,4%	5,5%	6,3%	4,5%	5,9%
Number of units (173) fully executed	20	71	46	24	4	7	0	1
Average camp size per group	337	1197	187	163	144	145	146	98

From the foregoing it is evident that 87,5 per cent of the total area of the soil conservation district has already been planned, but that on only 173 farm units, that is to say, 44,8 per cent of the planned units, are all works already completed.

However, a critical examination of the planning done shows that in many instances planning was not comprehensive enough. Of the planned units there are 42 per cent that have less than 12 camps per farm. This means that on 42 per cent of the farms grazing control cannot be effectively applied if it is taken into account that at least three herds are kept on each farm. Of the total number of planned units 126 (32 per cent) were planned in accordance with regional norms and on 34 (26,9 per cent) of the units all works have already been executed.

Karoo Region

Only one of the surveys in this Region will be summarised here. The findings of an investigation into irrigation farming in the *Upper Fish River area*, District of Cradock, may be summarised as follows:

Only 17 per cent of the 82 respondents can really be classified as irrigation farmers.

The average size of the irrigation plots is 66 ha, which accounts for 7,3 per cent of the total area.

About 74 per cent of the scheduled land is under irrigation.

Nearly 71,2 per cent of the land under irrigation is under permanent forage crops.

Only 43 per cent of the farmers apply an efficient crop rotation system.

Only 47 per cent of the farmers keep separate records of their income from the various enterprises.

On average six labourers are employed per farm.

The average capital investment per farm is R54 099.

The average gross income is R14 648 per year, of which an average of R8 277 is made from field crops and the rest from stock farming.

The average age of the farmers is 48 years.

The training qualifications of the farmers are as follows:

Standard 8 or lower - 33 per cent

Standard 9 or 10 - 45 per cent

Diploma in agriculture - 11 per cent

Advanced training - 11 per cent

Eastern Cape Region

An example of another aspect of extension is the potential surveys undertaken in the Eastern Cape Region.

Potential Surveys

Six technicians of the Region were occupied full-time with soil science, botanical and hydrographic surveys in the process of catchment area planning.

The accompanying table gives the overall position of areas where potential surveys had already been done by 30 June 1975:

Position of potential surveys on 30 June 1975

Subcatchment area	Size ha	Physical survey	Socio-economic survey
Bossieslaagte	29 949	Complete	Complete
Melkspruit	37 685	Complete	Complete
Waschbankspruit	34 871	Complete	Complete
Saalboomspruit	68 520	Complete	Complete
Upper Sterkspruit	26 977	Complete	Not yet
Osilaagte	35 282	Complete	Not yet
Klipspruit	65 682	Complete	Not yet
Bamboeswonderboom	75 334	Complete	63% complete
Stormbergspruit	94 862	Complete	63% complete
Upper Stormberg	31 771	Complete	63% complete
Total	500 933	All complete	

The table shows that soil science, botanical and hydrographic surveys have already been completed for an area of 500 933 ha. Lagging behind, the socio-economic surveys were completed in only four subcatchment areas and are still under way in three others.

In the year to come potential surveys in the Upper Orange catchment area will be continued.

IN-SERVICE TRAINING

In-service training of officers is a matter which receives constant attention. A few samples follow of what has been done in the Regions:

Transvaal Region

A short course for 10 extension officers and eight technicians was presented at the Nootgedacht Research Station as forerunner to four further courses presented at a later stage for members of the private sector and farmers.

The course dealt with the integration of natural veld grazing and artificial pastures and with livestock management practices in practical stock farming enterprises.

Eastern Cape Region

The scope of in-service training in this Region is illustrated by the table below.

Course	Attendance figures
Modern management techniques	14
Budgeting by objectives	14
Subdivision of agricultural land	14
New diary systems	13
Nematology	91

Winter Rainfall Region

Officers of the Region attended the following courses held locally or elsewhere during the year under review.

Course	Attendance figures
Induction course for public servants	4
Supervision	1
Modern management techniques	6
Budgeting by objectives	29
Potato production	5
Summer pruning and irrigation	19
Fruit cultivation	3
Soil classification	13
Management: Pig farming	9
Dorper classing and Boer goat judgin	2

AGRICULTURAL EDUCATION

In the following table the numbers of students attending diploma courses are given:

Student numbers at colleges of agriculture 1974/75

(Numbers in brackets are those of the previous year)



Miss A. Steenkamp of Klawer, who gained her agricultural diploma at the Stellenbosch-Elsenburg Agricultural College at the end of 1974, is the first woman to achieve this distinction at this College. On the right is Dr J.E. Erasmus, Director of the Winter Rainfall Region, and on the left Mr I.L. Ferreira, the college officer at Elsenburg

College	Student numbers
Cedara	127 (135)
Glen	57 (87)
Grootfontein	89 (65)
Neudam	39 (42)
Potchefstroom	123 (108)
Stellenbosch-Elsenburg	115 (101)
Total	550 (608)

The colleges of agriculture also presented a wide variety of short courses, particularly for farmers:

College	Number of courses	Attendance figures
Cedara	17	182
Glen	18	398
Grootfontein	10*	225
Neudam	46*	920
Potchefstroom	44*	1 149
Stellenbosch-Elsenburg	5	317
	140	3 191

*Includes all courses held in the Region concerned.

SUMMARY OF ACTIVITIES

In the following table an indication is given of the time spent by the professional officers and technicians on specific key tasks and the scope of the services rendered:



The P W Vorster Museum at the Grootfontein Agricultural College was inaugurated in 1975. The building is a restored farmhouse built in 1827. It contains rooms that illustrate the history of Grootfontein, the period of the Anglo-Boer War and the family history of early inhabitants of Grootfontein. The museum also contains an old-time parlour and kitchen

Activity	Professional		Technicians	
	% time spent	Statistics	% time spent	Statistics
Travelling: self (km)	14,3	1 487 016	13,8	2 112 694
Travelling: as passenger (km)	5,3	527 366	5,2	4869 725
Survey visits	13,2	10 712	14,8	19 450
Inspection visits	2,9	2 487	6,7	8 997
Extension visits	17,2	10 837	6,2	5 576
Surveys (contour banks)	-	-	3,3	8 792
Surveys (pipe line in k)	-	-	4,0	6 195
Surveys (other)	-	-	3,2	3 551
Gatherings	16,5	1 665 503	7,5	1 249 659
Interviews	15,7	37 449	10,6	41 639
Letters written	7,4	17 866	5,6	24 129
Reports written	4,4	5 002	3,1	5 544
Designing (pipelines in	0,3	129	5,1	4 008
Designing (other)	3,9	2 142	13,3	12 499

The following particulars complete the picture of the activities of the extension service:

Farmers' days organised	397
Demonstrations held	238
Properties inspected for weeds	10 825
Weed notices served	613
Farming competition held	112
Number of participants involved	970
Number of study groups	281
Number of study group members	3 082
Number of meetings held	1 274
Number of programme planning committees	117
Number of farmers involved as members	917

PUBLICATIONS

POPULAR PUBLICATIONS

The pamphlet service was extended considerably during the year under review and a total of 413 pamphlets with a combined printing of more than 1 034 000 copies were published. These pamphlets cover a wide range of subjects such as the cultivation of various field crops, vegetables, deciduous fruit, citrus and subtropical fruits, the

production of wine grapes, poultry, wool, engineering aspects, etc.

Apart from the pamphlets, 161 250 copies of the weekly newsletter *Agricultural News* were printed and distributed, as well as 59 850 copies of other newsletters, 41 650 agricultural reports and 23 100 copies of library lists, farmers' day lectures, manuals and commentaries for slide series. Eight pamphlets totalling 240 000 copies were distributed as a supplement to *The Golden Fleece*, and 83 625 copies of test reports on the Milk Recording Scheme and egg production tests as well as on milking machines, disc harrows, vine spraying machines, fans and planters were printed.

One popular pamphlet on beef cattle farming according to the Soutpan system, one issue of *Agricultural Research*, a publication on the control of animal diseases, and one issue containing recommendations and notes on the correct use of pesticides and fungicides were published. Altogether 10 254 copies of pamphlets and journals were sold.

The Departmental Annual Report (1973/74), four issues of *Agrekon* and two issues of *Trends in the Agricultural Sector* were prepared in both languages on behalf of the Department of Agricultural Economics and Marketing, as well as various speeches and lectures. One issue of the journal *Forestry in South Africa* (No. 15) was prepared on behalf of the Department of Forestry.

SCIENTIFIC PUBLICATIONS

AGROPLANTAE, AGROANIMALIA, AGRO-CHEMOPHYSICA, PHYTOPHYLACTICA

During the year 116 articles (89 in English and 27 in Afrikaans) were received, which is 14 articles less than in the previous year. Together with a carry-over of 98 articles from the previous year, 214 articles were therefore dealt with. Of these 135 were approved, 10 rejected, four cancelled, one was combined with another article, one classified as a Technical Communication, and 63 are still under consideration.

The year under review thus ended with a carry-over of 30 approved articles plus 63 still under consideration. Of these 93 articles three were received during 1972/73, 10 during 1973/74 and 80 during 1974/75. The approved articles all date from 1974/75.

The difficulties experienced in getting the journals up to date were therefore surmounted during the year under review.

ONDERSTEPSPOORT JOURNAL OF VETERINARY RESEARCH

Six issues of this journal appeared during the year, viz Volume 41 (1), (2), (3) and (4) and Volume 42 (1) and (2). These six issues contain 31 articles.

There was a slight increase in the number of articles received compared with the previous year. Of the total of 35 articles dealt with during the year 31 have already appeared while four are being carried forward.

OTHER SCIENTIFIC PUBLICATIONS

Other scientific publications brought out were the following: *Bothalia* Volume II, Nos. 3 and 4; *Flowering Plants of Africa*, Volume 43, Parts 1 and 2; *Entomology Memoirs* Nos. 40, 41, 42, 43, 44, 45; *Technical Communications* Nos. 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 131, 133;

and *Botanical Survey Memoirs* No. 40. *Technical Communication* No. 128 was withdrawn from circulation during the year under review.

AUDIO-VISUAL SERVICES

During the year 28 synchronised slide series were completed of which one was withdrawn at the author's request. A further 34 series are in various stages of completion, while various series were lent out or distributed 124 times.

Assistance was given to several Departmental organisations in the design, preparation and setting up of displays.

Lectures and demonstrations on the use of audio-visual material were given to several Departments and other organisations such as the Department of Bantu Administration and Development (agriculturists from the Homelands), the Foundation for Education, Science and Technology (science teachers and advisory council), and the University of Pretoria.

NEWS SERVICE

During the year under review the circulation of the weekly newsletter *Agricultural News* was further expanded on a selective basis, one of the reasons for this being the increasing interest shown by the agricultural commercial sector.

Although *Agricultural News* is primarily aimed at the press, it evidently fulfils the need for concise and factual agricultural coverage felt by a growing number of organisations that are in one way or other concerned with agriculture.

Apart from *Agricultural News* and an enquiry service, the news service took care of the daily radio news bulletin as well as all press and radio statements and news and speech releases.

CALLING ALL FARMERS

The almost overpowering demand for information in the agricultural industry has an important influence on the planning of programmes. The introduction of the Department's pamphlet service made it possible for the radio information campaign during the past year to be supported by published material as never before. Correspondence in this respect not only shows the increasing number of listeners, but at the same time also illustrates the wide spectrum of interest.

A salient feature of the year's work was the large number of farmers who took part in the programmes with officers, especially extension

officers. This gave the Department's extension effort the necessary impact.

The results of research were made known in hundreds of reports, talks and interviews. There is hardly a subject of interest to the agricultural industry that did not feature in some way or other. New programme series were tackled during the year under review and specific attention was paid throughout to the last trends and matters of current importance in this dynamic industry.

LIBRARY SERVICE

The library's services were publicised this year at three agricultural shows, viz Goodwood, Queenstown and for the first time at the Rand Show. A lively interest was shown everywhere and a considerable number of new members were registered. This resulted in a noticeable increase in the library loan figures.

One member of the staff was assigned as from April to the full-time compiling of bibliographies. This service is very popular and the requests have increased to such an extent that the number of bibliographies compiled from April to June has trebled.

Full-time staff have been appointed at the libraries in South-West Africa and the Winter Rainfall Region in order to promote this service at these offices.

The staff's in-service training programme is being continued. Lectures at the Division of

Library Services are regularly attended, and interesting and informative visits were paid to the Johannesburg Public Library and the Atomic Energy Board.

The library's own microfiche reader-printer has also been put into service. Rare or unobtainable works can now be purchased on microfiche. A number of theses have already been obtained in this form. The third issue of PISAL will appear on microfiche only and the tracing will be done for local branch libraries by the Central Library.

Important progress was made with the liaison with and services to the Division of Veterinary Services. Visits are paid two mornings a week to the Division's office in Pretoria in order to attend to the administration of the book collection and the receipt of periodicals. At the regional offices of the Division, library staff from the regional offices assist in certain specialist tasks and give guidance to the responsible officers in the administration of the book collections.

Particular attention was paid to the branch libraries to determine whether a satisfactory service is rendered. Visits were paid to most branch libraries, while comprehensive reports touching on every aspect of the service were written on the following libraries: those in the South-West Africa, Winter Rainfall, Eastern Cape and Karoo Regions, at Onderstepoort, and in the Division of Agricultural Engineering.

3. Natural Resources

MAPPING OF LAND TYPES

The mapping of land types in South Africa at a scale of 1:250 000 is about two-thirds complete. (A land type denotes land in which terrain form, soil pattern and macroclimate all display a marked degree of uniformity.)

The making of an inventory of natural resources and land use in the Pretoria - Witwatersrand - Vereeniging complex is proceeding slowly. The most time-consuming component of the project, namely the soil survey, was tackled first and this is now two-fifths complete.

Several detailed and semi-detailed soil surveys, covering 40 925 ha, were undertaken to evaluate the quality of land for irrigation. The areas concerned lie along the lower Orange River and the lower Gouritz River and near the following towns: Bloemfontein, Montagu, Touws River and Villiersdorp.

AGRICULTURAL METEOROLOGY

Climatic surveys were continued in various parts of South Africa and a number of new weather stations were constructed in the Orange River area with a view to future irrigation studies. A number of new weather stations were established in the Natal Region for maize research.

Other weather stations were constructed for the purpose of collecting data on problems such as pack-marked peel in citrus and adaptability in pineapples.

Data processing

The major portion of the daily rainfall data available from surveys by the Weather Bureau was recently made available to the Department on magnetic tape. The remaining rainfall data and data on the daily maximum, minimum and mean temperatures will also be available shortly.

Considerable progress has already been made with the development of the data system for the processing of data on agricultural meteorology. The system definition is complete and many of the programmes and subprogrammes have already been written. As soon as all the programmes are complete and the system has been tested it will be put into operation from the various terminals of the Department's computer.

The encoding of evaporation data obtained

from the Department of Water Affairs is virtually complete.

Agroclimate

Four of the 96 heat unit and photothermic unit maps that have already been completed were selected for publication in colour.

The distribution of the average monthly maximum, minimum and mean temperatures for the Republic of South Africa on the scale 1:2 500 000 has already been completed on a series of 36 maps. A selected number of these charts may be published later.

Computer programmes with the aid of which climatic data for the national agroclimate project can be analysed have been developed.

Evapotranspiration

The evapotranspiration of pears on dwarf rootstocks reached a peak during December - January, and losses from the A pan were obtained in January - February. It may be concluded from this that while the pear trees' evaporation figures keep pace with the maximum radiation at the end of December, A-pan losses are about a month out of phase with the incoming radiation.

Wind studies

Plastic material originally manufactured as a shade net was tested as a windbreak at the Bien Donné Experimental Farm. Whereas ordinary wire netting (13 mm) gives a reduction in speed of 9 per cent at best the figure for the new material was as high as 46 per cent, as the following table shows.

At Zebediela tests were carried out on fruit produced inside and outside windbreaks. Where unprotected citrus showed almost 10 per cent wind blemishing, only 2 per cent damage was found on protected fruit.

A survey which has been in progress for three years above the site of the Theewaterkloof Dam again showed that very strong north-westerly winds occur there. This indicates that when the dam is complete a driftsand problem will be experienced there.

Plant/climate relationships

When an agricultural meteorologist was assigned to the cotton research programme in the Transvaal Region a start was made with phenological observations of cotton at Loskop, Vaalharts and Upington. The dates of planting,

The percentage reduction in wind speed at various distances (H=height of windbreak) in front of and behind the windbreak

Distance from windbreak	+4H	+2H	-2H	-4H	-6H	-8H	-10H	-12H
13 mm wire netting	6	7	9	9	8	8	7	6
Shade net (40%)	16	19	46	43	37	30	26	20

germination, first leaves, flowering, opening of the bolls and harvesting, *inter alia*, were recorded together with meteorological observations of the stand of cotton.

In the South-Western Cape it was found that a warmer than average winter and a colder than average spring delayed harvesting dates by about 10 to 14 days. After the relation between weather factors and the picking dates of Dunn's Seedling and Granny Smith apples had been determined, apples were harvested in accordance with this information during the past season, stored and tested for ripeness. The results showed that the optimum stage of ripeness for picking export apples had been reached in only one case. The picking dates appeared to have been a week too early in most cases. This information will be used as a correction in future in the prediction of ripeness from meteorological data.

Good progress was made in the Natal Region with a model in which the development of maize from germination to maturation is analysed in terms of the macro- and microclimate of the environment. A method for determining the maize potential of land will be developed on the basis of this work.

IRRIGATION PLANNING

Various matters related to irrigation development are the responsibility of the Subdivision of Irrigation Planning of the Soil and Irrigation Research Institute. Since irrigation planning is a multi-disciplinary function, the Subdivision co-operates very closely with Institutes, Regions and Divisions and with other Departments.

Comprehensive agricultural situation determinations and evaluations with a view to irrigation development were carried out in various areas, including the following: Suider Paarl, Perdeberg, Duivenhoks River (Heidelberg), Agter-Cogman's Kloof (Montagu), Upper Bot River (Villiersdorp) and Vyeboom (Villiersdorp).

In addition the viability of the Klein Fish River Irrigation Board (Somerset East) and the Bellair Irrigation Scheme (Montagu) was investigated and reported on. In these studies the selection of land for irrigation development was based on an interpretation of physical properties (climate, soil, site morphology and drainage) and production economics properties.

For the Winterton and Douglas-Prieska areas the selection of land was based solely on the physical factor. A re-evaluation of the irrigability of the soils at Aspoort and the Lower Sundays River Valley was undertaken on the same basis.

The replanning of the Hardap Scheme was continued and the internal planning of all 18 new,

consolidated irrigation farms is now complete. The layout planning of farms in the Rust and Bleskop Developments (Vanderkloof Irrigation Scheme) was completed with the aid of the physical factor. The The Subdivision also advised these areas about what land would have to be purchased for irrigation development, and by taking the economic factor into account the relative monetary value of the planned irrigation farms was determined.

The other joint investigations undertaken on irrigation matters include the following:

The collection of data on the consumption of water by agriculture for the Eastern Transvaal Water Planning Committee

The completion of the report on brack problems in the Hex River Valley

The collection of production economics data in order to determine farm sizes in the Great Fish River Valley

IRRIGATION RESEARCH

Drip Irrigation

Soil moisture distribution and possible salt accumulation in several commercial drip irrigation systems and a number of experimental systems were investigated. It was found that salts that accumulate during the dry winter are leached away by summer rains.

Researchers attempted to maintain a desirable soil moisture distribution in a citrus orchard under drip irrigation with the aid of sensitive tensiometers. In this way the commercial daily application period during the dry spring was reduced from 2,5 to 1,0 or 2,0 hours per day, depending on evapotranspiration conditions. This represents a saving on water of about 250 m³ per hectare per month.

Many cases of over-irrigation in commercial drip systems were measured.

Soil moisture consumption by crops

The veld calibration of a neutron moisture gauge on a series of soils and the simultaneous measurement of the soil moisture consumption of wheat are being carried out on a number of plots on the Loskop Government Water Scheme and the Springbok Flats. The purpose is firstly to refine the technique so that the required degree of accuracy can be achieved with this extensive method of determining soil moisture consumption. Secondly, relations between soil moisture consumption and yield (the so-called water-yield functions) are being investigated.

This will make it possible to establish a soil moisture analytical service with the object of

determining water-yield functions under a wide range of practical conditions.

Weighing lysimeters

Basic studies on both the processes of determining the water consumption of crops and the part played by water in the various facets of crop production are possible only when water consumption (or evapotranspiration) can be measured very accurately over short periods. Weighing lysimeters are the most suitable equipment for this purpose.

Three weighing lysimeters were recently completed and calibrated and installed in an irrigated citrus orchard in the Sundays River Valley. The lysimeters each contain an adult citrus tree and have a mass of about 50 tons. Evapotranspiration can be measured accurately to within 0,3 mm of water, which makes it possible to follow evapotranspiration from hour to hour.

Four smaller but considerably more accurate (0,05 mm of water) lysimeters, suitable for field crops and vegetable crops, have already been installed at Roodeplaat and are at present being prepared for experimental work. The surrounding area is being equipped with irrigation equipment with the aid of which measurable quantities of water can be applied separately to the trial plots that have been marked off.

SOIL CONSERVATION

Experience during the past five years - since the new Soil Conservation Act has been in operation - has shown that there are very few cases where summary disciplinary action against offenders under the Act is possible. There is generally a time lag between the date when an offender is warned about some form of soil abuse and the date when there is sufficient evidence that the offender has no intention of co-operating and it is clear that disciplinary action will be necessary. The policy of the Division is to try, by means of correspondence, personal negotiations, or both, to persuade offenders to co-operate, but in cases where no co-operation is obtained legal action is unfortunately the only alternative.

• Letters and visits to persons suspected of malpractices have helped a great deal to make the farming community at all levels aware of the new Act and its objects and have at the same time served as evidence that the Division is serious about applying the Act.

Disciplinary action

The accompanying table reflects the regulatory control measures (disciplinary action) from the commencement of the new Act up to and including 30 June 1975.

An analysis of the number of potential problem cases during the past five years showed that 66 per cent of the persons concerned responded favourably to advice from the extension staff or a warning from the Division of Soil

Period	Number of potential problem cases	Number of directions	Number of court cases
Up to 30/7/71	2 387	90	0
1971/72	2 332	97	2
1972/73	1 655	75	7
1973/74	1 100	91	13
1974/75	843	75	1
Total	8 317	427	23

Protection; negotiations are still in progress with 23 per cent. The 11 per cent that responded unfavourably to advice and warnings will eventually have directions served on them.

As may be seen from the table 427 directions have already been served by the Division and these directions have resulted in only 23 court cases. An analysis of these figures shows that only 5,4 per cent of the occupiers of land on whom directions were served contravened those directions. The other 94,6 per cent of farmers are obeying the directions and are complying strictly with the requirements. A consideration of the main type of offences or malpractices in respect of which the various directions were served is very revealing. The following table gives an analysis of the situation.

Offence in connection with	Number
Protection of cultivated lands	134
Temporary withdrawal of eroded areas	101
Resting of veld/rotational grazing	107
Restriction of livestock numbers	85
Total	427

It is evident from the first table that the number of suspected offenders with whom contact is made each year is decreasing all the time. During 1974/75 the number of directions and court cases decreased sharply.

Soil conservation committees

The terms of office of the first committees under the new Soil Conservation Act ended on 30 September 1974. In consultation with Organised Agriculture, the new committees have already been appointed for a further period of three years with effect from 1 October 1974. In the Republic and South-West Africa there are 266 of these committees with a membership of 2 045.

The new committees have already held their inaugural meetings and some of them are busy with programmes for the new year.

Regional advisory committees

The first terms of office of the various regional advisory committees expired on 31 December 1974 and the members of the advisory committees for the various regions were reappointed for a period of three years with effect from 1 January 1975. Most of the new regional advisory committees met once or twice during the year under review.

The Soil Protection Advisory Board

The term of office of the first Soil Protection Advisory Board expired on 31 December 1974. The new Board has already been appointed by the Minister for a period of three years with effect from 1 January 1975.

Two meetings were held during the year under review and a tour of South-West Africa was undertaken in June 1975. The Senior Deputy Secretary (Professional) summed up the impressions of the Board as follows:

1. State land, of which there is a great deal in South-West Africa, should be so utilised that it serves as an example to farmers and other members of the public.

2. The stocking rate plays a very important part in successful veld utilisation. With the correct carrying capacity - and the carrying capacity can be adjusted in the short term - great progress with veld recovery is possible.

3. Unequivocal guide-lines on conservation farming are required. The Department of Agricultural Technical Services should take the lead here.

4. Bush encroachment is a pressing problem in the northern parts of South-West Africa and in large parts of South Africa. The Board was very gratified to learn of the good progress being made in South-West Africa with regard to bush encroachment, but is sure that a great deal of research work is still required in this field.

5. Erosion follows bush encroachment and makes control so much more urgent.

6. The playa at Maltahöhe is typical of the big areas of exposed soil in large parts of South Africa. These playas generally occur in areas with a low rainfall and heavy soil.

7. Research on the causes of erosion and protective methods should enjoy more attention.

Farmers' works

Expenditure on subsidies and grants in respect of completed soil conservation works and schemes such as the Stock Reduction Scheme, various flood assistance schemes and other financial expenditure under the Soil Conservation Act followed more or less the same pattern as in the past.

The following table shows expenditure over the past five years on subsidies on soil conservation works, grants for the repair of flood damage and grants for grass ley crops on lands.

Year	Subsidies on completed soil conservation works	Grants for flood damage repair	Grants for grass ley crops on cultivated lands
	R	R	R
1970/71	2 967 684	599	11 849
1971/72	4 042 794	2 219	13 000
1972/73	4 239 404	10 161	15 684
1973/74	4 533 282	8 674	7 688
1974/75	4 993 979	1 132	2 824

These figures apply to the Republic and South-West Africa. The table shows that there has been an increase in the subsidy on completed soil conservation works. This increase may be ascribed chiefly to the increased subsidy rates (fences on 1 October 1973 and again on 1 April 1975 and other soil conservation works with effect from 1 April 1974).

Most completed works still fall into the category of works for the indirect control of erosion and stock-watering points. Works for the direct control of erosion are still not enjoying the attention they merit, although the Highveld Region reports that 1 207 km of contours have been pegged out during the past year, of which only 295 km have been completed and submitted for subsidy purposes. According to this Region progress with the pegging out and construction of artificial waterways has again been very encouraging. The surveying of a further 520 waterways during the past year brings the total for the Highveld Region to 2 728.

According to the Transvaal Region only 5,32 per cent of the total subsidy paid on soil conservation works in the Region during the past year was spent on works for the direct control of erosion. The rest, namely 94,68 per cent, was spent on internal camp fencing and stock-watering points, which indicates that the emphasis in farm planning is still being placed on development works.

Most regions reported a drop in the number of initial farm plans. This is understandable because farm planning was introduced in 1946 under the old Soil Conservation Act and there cannot be many more farms on which the initial planning has not yet been carried out.

There has been an increase in replanning, on the other hand, because as soil and veld classification gains momentum the old, original plans have to be adapted to new technological developments.

Run-off control planning is becoming increasingly important and major farmers' works are therefore also likely to show a gradual increase. The Highveld Region reports that interest in run-off planning in particular is very keen.

State works

The erection of soil conservation works at key positions, which is being undertaken by the Division of Agricultural Engineering, is progressing systematically. This erection of works is preceded by the run-off control planning of catchment areas and the planning of all the farms involved. The chief projects were the building of new State and major farmers' works in the Upper Orange and Sand River catchment areas. In all 25 damaged soil conservation works had to be repaired.

Progress is indicated in the following table.

Catchment area	New works completed		Repairs completed	
	Number	Value (R)	Number	Value (R)
Modderbultspruit	5	158 200		
Brakrivier			3	22 000
Elands river			1	4 000
Vlekpoort			10	35 000
Sundays River			1	12 900
Broekpoortspruit			2	5 000
Bossieslaagte	7	79 005		
Wintershoek	2	70 355		
Melkspruit	1	84 477		
Stormbergspuit			1	1 523
Great Kei River			1	3 207
Sand River	2	71 100	6	134 200
Total 1974/75	17	463 137	25	217 830
Total 1973/74	8	451 529	15	85 300
Total 1972/73	3	765 759	17	149 317
Total 1971/72	9	401 071	9	115 979

Soil conservation research

Research undertaken by the Division of Agricultural Engineering during the year under review confirmed the following:

1. The cutting down of reeds, the levelling of sediment humps and the removal of trees from watercourses again showed good results.

2. Where the bevelling of walls is achieved the danger of erosion is greatly reduced.

3. It is very important to maintain a balance in the density of the vegetation on the two banks of a watercourse. It is equally important to give attention to the correct alignment of the watercourse.

4. The jacks are still producing good results.

5. Natural veld and reeds deteriorate if they are not grazed or cut. Some degree of grazing is therefore necessary.

6. If eroded watercourse banks are to be improved at all it is essential that as much moisture as possible is allowed to penetrate and that the moisture is conserved there as long as possible. For this purpose it is necessary to provide a grass mulch. The results so far have shown that this is very effective.

7. Without exception the introduction of red grass seed *Themeda triandra* and a

mulch on bare or sparse veld produced a great improvement.

8. The introduction of seed of a climax grass such as red grass on veld that already has a fairly good cover but where the poorer types of grass are predominant is of the utmost importance. Research aimed at determining how thin the seed can be spread while still serving the purpose is continuing.

Veld fires

In Natal the veld fire guidelines of the various soil conservation committees were standardised during the year under review. Nine thousand copies of standardised veld fire guidelines, complete with area maps, were sent to landowners in the Region by certified post. For the purposes of the new veld fire regulations, Natal is divided into three main veld groups, on the basis of the bioclimatic groups, viz:

Humid grassveld
Arid long grassveld
Arid thornveld

These amended veld fire regulations will not only assist the soil conservation committees in their supervisory duties but also make the task of the Division of Soil Protection very much easier.

The Stock Reduction Scheme

The first group of collaborators completed their five-year term during the year under review; this is one of the major events since the introduction of the Stock Reduction Scheme in 1969.

The Scheme is based on two important principles, viz that stock numbers should be kept low and that the veld should receive sufficient rest.

The application of these principles means considerable expenditure for the State, since compensation is paid under the Soil Conservation Act for livestock units withdrawn in terms of a contract between a collaborator and the State.

Total expenditure in all areas where the Stock Reduction Scheme applies

Year	Republic of SA	SWA
	R	R
1970/71	611 853	-
1971/72	7 906 502	321 900
1972/73	10 713 940	1 057 607
1973/74	9 046 140	1 292 931
1974/75	8 171 637	1 143 537
Total	36 450 072	3 815 975

During the first five years the Scheme was in operation the cost was R40 266 047. The last collaborators will leave the Scheme in 1978.

The Director of the Karoo Region states that, as a result of the Stock Reduction Scheme, more farmers were convinced of the advantages of running fewer livestock and resting the veld during the past five years than during the preceding 25 years.

This view is supported by the following facts:

Very few farmers will go back to their former higher stock numbers;

farmers are convinced of the need to rest the veld; and

farmers have got to know their veld.

The beneficial results of the Scheme are illustrated by the following:

The participants in the Scheme obtained a bigger income per hectare than non-participants with a higher stocking rate, especially in dry years. During the two good years (1974 and 1975) that followed, participants maintained a higher income per animal than non-participants, but not a higher income per hectare. It therefore appears that the stocking rate is a decisive factor in the long term.

Although climatic conditions play a very important part, there is a strong indication that the veld of participants has built up a greater resistance to drought. The results of plant surveys confirm this. Because there was less rain the percentage plant cover in the Carnarvon extension ward decreased this year. In the case of participants in the Scheme the average decrease was only 3,8 per cent, but in the case of non-participants it was 25,8 per cent.

In December 1973, when Cradock was going through a dry period, Mr A.M. Marais of Ebenhaezer, Cradock, mated 195 Merino ewes in a rested camp and marketed 230 lambs at two months. A number of twins and six triplets were born. He ascribed this high lamb crop exclusively to the favourable feeding conditions that resulted from the Stock Reduction Scheme.

Mr K.W. van Heerden of De Vlei, Hofmeyr, reports astonishing results. His veld tracks are now so overgrown that he does not want to take a vehicle into his veld. Whereas the previous owner ran 800 head of small stock on 513 hectares, he runs only 200. Every year he markets the wethers from that veld and obtains record prices.

The extension officer at Jansenville reports that the Stock Reduction Scheme has been one long success story of veld improvement and increased production.

One outstanding result of the Stock Reduction Scheme has been the tremendous change in the attitude of farmers towards corret veld control measures. This is where the greatest value of the Scheme lies.

Originally it was said that the Scheme would only succeed if the attitude of participants towards their veld changed. It is encouraging that it has been reported from *all the Regions* where the Scheme applies that the change in the attitude of participants is one of the most important results of the Scheme.

A new approach and a new conservation consciousness among participants is reflected by the report from the Eastern Cape Region that 74 per

cent of the participants intend to run fewer stock in future. Knowledge of and interest in the vegetation improved in the case of about half the farmers, and 40 per cent showed an improved knowledge of and interest in grazing control systems.

Most of the participants in the Free State Region also included a grazing control system, better facilities and reduced livestock numbers in their farming practices. They have come to realise that livestock numbers were too high in the past.

Answers to a questionnaire in the Karroo Region show that 84 per cent of the participants are in favour of reduced livestock numbers. Although participants were in favour of grazing control systems, a large percentage were of the opinion that 12 months of resting veld, especially grassveld, was too long.

Notwithstanding all these encouraging signs, it should be remembered that changes take place very gradually and that even now there are many participants who are not fully convinced of the advantages of conservation farming. There are still too many farmers who do not realise that important adjustments in farm sizes and the stocking rate are required in the arid areas in order to conserve agricultural resources.

THE SUBDIVISION OF AGRICULTURAL LAND ACT

2 January 1971 to 30 June 1975

After 4½ years there are no signs that the number of applications for the subdivision of agricultural land is dropping at all; indeed there has been a slight increase.

Number of applications dealt with under the Subdivision of Agricultural Land Act, 2/1/71-30/6/75

Period	Approvals		Rejections		Total
	Number	%	Number	%	
2/1/71 - 30/6/71	331	67	158	33	489
1/7/71 - 30/6/72	725	74	252	26	977
1/7/72 - 30/6/73	659	81	157	19	816
1/7/73 - 30/6/74	715	74	253	26	968
1/7/74 - 30/6/75	848	74	294	26	1 142
Total	3 278	75	1 114	25	4 392

This may be ascribed to the constant stream of bequests, development in areas with a high potential, the keen demand for agricultural land for the expansion of cities and towns and other non-agricultural purposes. This type of application has more or less settled into a fixed pattern where one out of every four applications is not successful. Applications are turned down where the portions that will be created do not comply with the minimum requirements for land size or where good agricultural land is involved and it is not in the national interest to use the land for non-agricultural purposes.

Subdivisions for agricultural purposes

The majority of the applications for subdivision, viz 72 per cent, involve using the land solely for agricultural purposes. In this case 79 per cent of the 3 148 applications were approved, which indicates that landowners apply a selection process themselves in this category. Although the consolidation of farm units is not a direct aim of the Act, consolidation takes place on a fairly large scale in practice. This should be ascribed largely to the positive attitude of landowners.

Number of subdivisions for which permission was granted and the number of farm units and the area combined with other farm units as a result of consolidation - 2/1/1971 - 30/6/1975

Period	New farm sections created	Number of farm units	Area ha
2/1/71 - 30/6/71	233	116	48 951
1/7/71 - 30/6/72	152	436	108 799
1/7/72 - 30/6/73	134	342	88 178
1/7/73 - 30/6/74	116	503	164 358
1/7/74 - 30/6/75	158	523	174 203
Total	793	1 920	584 489

The 3 278 applications for subdivision or subdivided shares approved since 2 January 1971 have resulted in the creation of only 793 new farm units. It may be concluded that farm units are small in general and cannot be subdivided further. On the other hand 1 920 farm units disappeared as separate units as a result of subdivision and were consolidated with another farm unit or other farm units. The extent of the process of consolidation only becomes clear when one realises that one out of every five farm units involved in applications is absorbed into other farms units as a result of consolidation.

The same tendency can be seen in the reduction of the number of owners where land is kept undivided.

Subdivision of agricultural land for non-agricultural purposes

Applications for the use of agricultural land for non-agricultural purposes may be divided into two groups, viz extensive residential and commercial purposes and intensive urban use such as township development.

As is clear from the data contained in the following table, it is mainly extensive occupation that is restricted by the Act.

The subdivision of agricultural land into small residential units of two to five hectares remains popular. This type of application still makes up the highest percentage of rejected applications. According to the table about 16 000 ha of agricultural land has already been sacrificed for residential and commercial purposes. These include existing and new shops, hotels, motels and other business and industrial purposes, mining, and a few cases of occupation.

The 434 applications and about 32 000

hectares for which approval was not granted were intended chiefly for smallholdings, although a number of pleasure resorts also fall into this group.

The withdrawal of about 8 000 ha of agricultural land annually for township development is an aspect which requires to be carefully watched, especially if it is borne in mind that urban development takes place chiefly in agricultural areas with a high potential.

Regional planning is essential to prevent good agricultural land from being lost. The approximately 10 000 ha withdrawn from agriculture annually, with the necessary permission, during the past five years represents only a small part of the actual loss, since it does not include the land needed for roads, railways, airports and other uses where there is no question of subdivision.

SOIL FERTILITY STUDIES

There is an increasing need in the agricultural industry for soil and plant analytical services that provide advice on fertilising. The co-ordination of Departmental efforts in this field was entrusted to the Soil and Irrigation Research Institute, which is assisted by a committee whose members are directly concerned with soil fertility research and advice on fertilising.

The Departmental committee met in November 1974 and June 1975. The progress made in the field of analytical services was thoroughly evaluated, shortcomings were identified and guidelines laid down for the future. Working groups paid particular attention to the following matters:

1. The standardisation of analytical methods. A guide was compiled for this purpose.
2. Correlation techniques (the determination of the analytical procedures for various nutrient elements, the results of which show the closest relationships with crop yields); and calibration (the establishment of norms and production relationships) for which guidelines were also laid down.
3. Liaison and co-operation with the private sector.
4. The introduction of a computer data bank system in which data on correlation, calibration and fertilising advice can be stored.
5. The creation of a national monitoring system for soil and plant analyses in accordance with which standard samples will be sent periodically to all laboratories to ensure that the necessary accuracy is maintained.
6. The creation of a national technical communication system for analytical services and fertilising advice.

During the 1973/74 and 1974/75 growing seasons a programme was launched with the aim of obtaining more definite standards for the quantity of N, P and K removed in the seed of the most

Period	Occupation and commercial						Township development					
	Approved			Rejected			Approved			Rejected		
	Number	%	ha	Number	%	ha	Number	%	ha	Number	%	ha
2/1/71 - 30/6/71	74	54	2 612	65	46	7 244	11	92	1 426	1	8	66
1/7/71 - 30/6/72	129	56	2 825	100	44	8 259	29	97	1 152	1	3	13
1/7/72 - 30/6/73	91	63	3 879	53	37	3 998	74	94	10 763	5	6	1 338
1/7/73 - 30/6/74	105	50	3 361	103	50	6 975	90	98	8 133	2	2	432
1/7/74 - 30/6/75	86	43	3 706	113	57	5 700	97	95	13 751	15	5	3 296
Total	485	53	16 383	434	47	32 176	301	93	35 225	24	7	5 145

important annual field crops grown in the Highveld Region. An attempt was also made to relate these data to factors such as the cultivar, soil series, fertilising, yield and soil-climate combinations.

The investigation was undertaken because the so-called "uptake figures" are at present fairly generally used in the calculation of the quantity of N, P and K required for crops such as maize under dryland conditions.

Great variations in the concentration of elements were found, even for seed of the same cultivar. The following table gives the average concentration of a few elements in the seed of a number of crops.

A critical examination of the analytical data from soil samples from the districts of Hertzogville and Christiana indicates that there are no significant acidity problems in these areas, but 76 per cent of the samples show phosphorus deficiency. It may be concluded from these results that most fields still have to be fertilised to raise the phosphorus status to the desired 10 p.p.m.

The average Zn value is only slightly higher than the threshold value, so the Zn status requires watching.

Compost

Urban compost, over 30 000 tons of which is produced mechanically by five municipalities in the Western Cape, is used mainly in the agricultural

sector. Chemical analysis of samples of this compost received regularly from the four biggest compost plants over a period of two years showed the following:

1. Compost from the four plants differs so little in appearance and chemical properties that it can be regarded as the same product.

2. The compost is "aesthetically" acceptable, although the remains of soft plastic in particular can sometimes be recognised.

3. The compost is crumbly and easy to spread.

4. With the usual levels of application of up to 300 m³ per ha no toxicity to agricultural crops was found.

5. The average composition of urban compost is 1% N, 0, 5% P, 0,25% K, 3% (Ca+Mg) and 50% organic matter.

The low sulphur content of sandy soils in the West Coast area was confirmed in pot trials. The fact that sulphur deficiencies are not found in practice is due solely to the use of superphosphate, which contains 13 per cent sulphur, as a fertiliser. Where sulphur is not present in the fertilising programme the soils cannot supply the sulphur requirements of rye grass and deficiencies of between 9 and 62 per cent are experienced.

After the initial reclamation work had been carried out on the flood-damaged experimental plot at Cradock the calibration studies of the three most

Average percentage of N, P, K, Ca and Mg in the grain/seed of a number of crops grown under dryland conditions in the Highveld Region: 1973/74 and 1974/75

Crop	Number of samples	Concentration in seed / grain (% on flue-cured basis)				
		N	P	K	Ca	Mg
Grain sorghum	72	1,64	0,25	0,35	0,03	0,12
Groundnuts	40	3,69	0,39	0,65	0,04	0,19
(Natal Common)	(25)	(3,72)	(0,39)	(0,67)	(0,04)	(0,19)
Wheat	178	2,41	0,32	0,40	0,12	0,20
(Betta)	(49)	(2,53)	(0,34)	(0,38)	(0,11)	(0,21)
(Scheepers 69)	(73)	(2,40)	(0,30)	(0,41)	(0,13)	(0,20)
Maize	213	1,61	0,25	0,29	0,03	0,09
(PPK x 64R)	(15)	(1,62)	(0,27)	(0,30)	(0,03)	(0,10)
(SA 4)	(36)	(1,60)	(0,25)	(0,27)	(0,03)	(0,09)
(SSM 42)	(35)	(1,65)	(0,26)	(0,30)	(0,02)	(0,09)
(SSM 40)	(15)	(1,55)	(0,26)	(0,32)	(0,05)	(0,10)
Kidney beans						
(Large white)	4	3,61	0,43	1,72	0,11	0,19
Soya beans	6	5,03	0,56	1,88	0,23	0,22
Sunflowers	53	2,73	0,55	0,75	0,16	0,32
(Frans Lever)	(12)	(2,62)	(0,55)	(0,77)	(0,19)	(0,32)
(Kort Rus)	(11)	(2,49)	(0,56)	(0,75)	(0,21)	(0,36)
(Smena)	(18)	(2,81)	(0,55)	(0,77)	(0,19)	(0,32)

important soil types of the Fish River Valley were continued. The most important finding was that although the soils were under water for a few days after the flood in March 1974 there was no decrease in the brack content of the soils.

OTHER SOIL AND WATER STUDIES

Climate mapping and the mapping of land types, the physical, chemical and mineralogical description of soils, and the investigation into water quality and soil-water interactions form an integral part of the overall resource survey in South Africa, in addition to soil classification and soil surveys. The purpose of the overall resource survey is to promote the better utilisation of the resources - soil, climate and water - and to lay down a clear policy for additional research.

Chemical and mineral properties

A series of analyses were carried out on 847 representative soil samples in order to identify chemical properties.

The clay mineral properties of soils were investigated by means of X-ray diffractograms and the chemical determination of the clay fraction composition.

The description of the soil physical properties of soil samples from the resource survey programme was continued. In the course of this project the properties of the soil samples are determined in relation to their groundwater constants, structural stability, erodibility index (dispersion ratio) and soil crust strength (modulus of rupture). During the past year about 1 000 disturbed soil samples were examined in this way.

Hydrological properties

The investigation of the hydrological properties of certain important soil types was continued. The results obtained were such that it will be possible to apply and evaluate them in the field shortly with the aid of lysimeters and mathematical models describing the soil-water-plant systems. These data can also be used in the study of the water consumption of crops under dryland and irrigated conditions.

Mathematical soil models

A project aimed at evaluating the contribution of irrigation practices and water quality to the salinification of the water in the Great Fish River was started with the co-operation of the National Institute for Water Research of the CSIR. Mathematical soil models will be used to simulate the chemical reactions between soil and water and the movement of water in the soil.

Drainage

Seven years after the installation of an experimental subterranean drainage system on a plot at Vaalharts it is still possible to regulate the

level of the water table. The water table can be adjusted to a depth of between 0,9 m and 1,7 m at any time merely by opening or closing the tap on the system.

It was found in the course of laboratory and pot trials that calcium silicate is better than dolomitic lime and agricultural lime for raising the pH of acid soils.

It was shown by means of pot trials that there are statistically highly significant differences between various apple rootstocks with regard to the uptake and translocation of sodium from brack water. Rootstocks such as MM106 and MM111 can therefore not be recommended for conditions where brack water is used because they produce the highest concentration of sodium in the leaves of the scion.

Under the same conditions stone fruit varieties and cultivars of the same variety differed radically with regard to the accumulation of sodium in the leaves under the same conditions. Contrary to the general belief, no indication was found of suppression of sodium uptake by potassium or vice versa.

A method of determining soil moisture and soil density with the aid of neutrons and gamma rays has been designed. In an irrigation trial with various soil types this method eliminated the establishment of 27 different calibrations of the neutron moisture gauge, which would have taken several weeks.

Investigations have also shown that the neutron moisture gauge can be used at depths of less than the recommended 30 cm. Investigations into the relation between soil moisture losses and A pan evaporation showed that the relation remains fairly constant at a minimum depth of 40 cm, but above that level it varies according to the water content of the topsoil.

ANALYTICAL SERVICES

The small decline in number of soil samples received for analysis from farmers in Natal in 1973 (2 493) as compared to 1972 (3 048) changed into an increase in 1974 (2 914). In 1974, more samples from Natal were analysed by Cedara than by the fertiliser industry laboratories combined (excluding samples from the sugar industry).

Difficulties are still being experienced in keeping analytical capacity ahead of demand, especially during the period of peak sample flow. A solution to the problem of raising analyst productivity is being sought through intensified mechanisation of soil extractions and automation of extract analysis.

In 1974 the feed analysis section analysed 378 proteins, 28 fats and 89 fibres on feed samples received from farmers. Only a small fraction of available analytical capacity is being used by farmers.

The Citrus and Subtropical Fruit Research Institute received 5 000 soil and leaf samples for analysis. 2 340 samples came from producers and 2 660 were analysed for research purposes. The

number of determinations carried out on these samples was 46 520.

The current development programmes in the Highveld Region have led to a big increase in the number of samples submitted for purposes of analysis. However, it appears that this increase is the result of research work and that the Region's analytical service is used very little by farmers.

Leaf analyses for a number of good olive orchards during two seasons show that the leaf composition corresponds well to overseas standards for all the most important nutrient elements except boron, which was under 20 ppm in most of the orchards. The data on the change in the element concentrations in the leaves during a full growth cycle indicate that the best time for taking leaf samples is during July and August.

USE OF FERTILISER

During 1974 2 527 995 metric tons of fertiliser was used for growing agricultural crops. This amount includes 253 263 tons of nitrogen, 156 815 tons of phosphorus and 112 991 tons of potassium.

To counteract soil acidity 1 249 070 tons of calcitic and dolomitic agricultural lime, 1 431 tons of slaked lime and 6 417 tons of calcium silicate were used.

NATURAL GRAZING

The past season has been generally favourable. The two successive good rainy seasons have been of great benefit to the veld, which has recovered remarkably in respect of both the grass cover and the composition. The beneficial effect of the Stock Reduction Scheme has been magnified by the good seasons experienced.

The effect of the Stock Reduction Scheme combined with the good seasons has been to create considerable interest among farmers in more information on judicious veld control methods. It is reported from virtually all the Regions that this interest has resulted in the launching of programmes aimed at bringing home to farmers, by means of farmers' days, field days, grazing courses, farming competitions and study groups, the importance of grazing management and conservation consciousness.

The emphasis is placed mainly on the basic principles of veld control, the right number of animals, the restriction of the number of herds and the creation of facilities required for the application of judicious veld utilisation systems.

The problems that have emerged as a result of the favourable conditions include the difficulty of utilising mature plants efficiently. Apparently most farmers do not have sufficient camps to apply sound veld control measures systematically. This makes the utilisation of mature veld even more difficult. In order to utilise the veld better stock ticks based on veld plant analyses are recommended in several regions.

Research programmes involving the measurement of the production potential of the

veld in order to obtain standards according to which permissible livestock numbers for a particular area can be calculated are in progress in several regions. In the South West Africa Region the grass yields amounted to only about a third of the yields of the previous year, when there were abundant rains. The drop in the yield corresponded to the decrease in the perennial grass cover in the camps. The stocking rates are adapted from year to year to the edible grass yields. The following lambing percentages were obtained with Karakul ewes in South West Africa:

4 camp system - 142,3%
6 camp system - 148,8%
6 camp system - understocked, numbers made up by oxen - 152,8%
10 camp system - 162,3%

The most important grass species in several areas of the Eastern Cape Region are being studied to determine their production potential and growth curves. These investigations are not yet complete, but it would appear that factors such as soil depth and the clay content of soil play a big part in determining the type of vegetation and the stage of succession of the vegetation.

It was clear from the study of growth curves that rainfall is the biggest single factor in determining growth. More than one initial growth period may therefore occur per season, which underlines the view that fixed grazing periods should not be followed.

Flexible grazing systems, based on having sufficient camps per herd and moving the stock out of the camps in accordance with the state of the veld, are becoming increasingly popular.

In the Winter Rainfall Region 1 360 kg of seed was harvested from 25 promising indigenous edible plants. The seed will be used in radical veld improvement programmes and for driftsand control.

The vegetation of the Grootspuit Subcatchment, which is situated in the District of Fouriesburg, was mapped during 1972 by the grazing staff of the Bethlehem Research Station. It was possible to determine various vegetation/habitat relationships by means of a quantitative map interpretation technique that was subsequently developed. This made a fairly accurate description of the disturbing condition of the area during the survey possible.

The results showed that there had been a great deal of retrogression as a result of overgrazing. *Eragrostis chloromelas* occurred as dominant species on about 94 per cent of the ungrazed areas, which constituted almost 48 000 ha. The basal cover of the grassveld varied from 3 per cent to 6 per cent on half the area of the survey. The invader shrub *Aster filifolius* has taken in 68 per cent of the grassveld. Trees and shrubs, mainly *Leucosidea sericea*, occur on 30 per cent of the uncultivated areas. The relatively unfavourable physiographic properties of the area and the fact that farmers overestimate the carrying capacity are



These two photographs were taken on two farms about 10 kilometres apart in the southern Kalahari area of South West Africa. Good veld management gives a luxuriant cover of perennial grasses - contrasted with desert conditions due to bad management





A good stand of wool grass *Anthephora pubescens* sown on the Neudam Experimental Farm

probably responsible for the poor plant composition and the high silt run-off in the area.

Winter grazing of veld

At Potchefstroom the winter utilisation by cattle of veld rested during the previous summer revealed that this practice can bring about significant changes in the plant composition of the veld. For instance, least damage was done to red grass *Themeda triandra* and *Digitaria eriantha* by grazing the veld during autumn and early winter, whereas late winter was the worst time for grazing both grasses. On the other hand, grazing during late winter resulted in an increase in wire-grass *Elyonurus argenteus* and turpentine grass *Cymbopogon plurinodis* and the autumn and early winter were the worst times for grazing. This shows that undesirable grasses such as wire-grass and turpentine grass can be controlled and desirable grasses such as red grass and *Digitaria eriantha* can be encouraged by grazing veld that has been rested during the preceding summer in autumn and early winter.

Fertilising the veld

It was found at Potchefstroom that where nitrogen alone or phosphate alone was administered to the veld there were no significant increases in the yield of dry matter. However, if the two fertilisers were applied together in the ratio of 1 part of phosphate to 10 parts of nitrogen, considerable increases in plant production were obtained.

It was also found that nitrogen fertilising alone resulted in no major botanical changes, even when applied in quantities of up to 240 kg per ha. However, where as little as 7,5 kg of phosphate per ha was applied, 120 kg of nitrogen per ha was enough to produce a dramatic reduction in the red grass *Themeda triandra* and wire-grass *Elyonurus argenteus* in the veld composition.

At Potchefstroom no differences in the dry matter yield from veld were obtained by applying nitrogen in various forms, namely LAN (26%), ammonium sulphate (20,5%) and urea (46%). Other fertilisers such as Ca and S, which were added to N sources that were deficient in them, produced no increase in plant production either.

The various sources of phosphate used for fertilising the veld were also tested at Potchefstroom. It was found that superphosphate produced a higher plant matter yield during the first year after application than Langfos and apatite dressings did. After four years, however, there were no significant differences in the yields from plots that had received the various forms of phosphate.

The production of Karoo bush seed

During the past season 1 360 kg of seed was harvested from 25 promising edible plant species, including *Osteospermum sinuatum* (bitow), *Pollichia campestris* (waxberry) and *Manochlamys albicans* (soap bush).

Large quantities of seed can be harvested with the aid of the newly designed machines which have been put into use.

The seed is intended for radical veld



The wire fence divides the good from the poor. This photograph, taken in the Northern Cape, shows bare veld with bush encroachment on the left, against an outstanding cover on the right with good management

improvement trials and investigation into driftsand control.

Bush Encroachment

The increasing density of existing bush communities and the encroachment of bushes and shrubs in relatively open communities remains one of the biggest problems in the bushveld areas. It is estimated that bush is suppressing the edible grass yield on about 20 million ha in the Republic and South West Africa.

In large areas bush encroachment has assumed such proportions that methods of control that require the individual treatment of trees or shrubs are out of the question and the possibility of aerial spraying was investigated in the course of the research programme.

An aerial spraying project on two veld types in the northern subregion of South West Africa produced even more promising results than had been expected, although it is still too early to draw any final conclusions. The findings are as follows:

1. Exceptionally low doses of the weedkiller Tordon 225 (a mixture of 2,4,5-T and picloram) were effective.

2. The weedkiller acted selectively and was more toxic to the aggressive bush varieties such as swarthaak, sickle bush and Cape lilac than to the useful bushes and trees such as shepherd's tree, wild currant and red bush-willow.

If these results are finally confirmed they will hold out a prospect of a considerable increase in beef production in large parts of South West Africa. With some of the lowest effective doses the total spraying costs were brought down to about R10 per hectare. Even as little as 0,75 litres of weedkiller per hectare did serious damage to over 80 per cent of the invader bushes. Only after a year will it be possible to see whether these bushes will die or not.

Mesquite *Prosopis* sp., which is often planted as a fodder tree or for shade, is spreading rapidly

in parts of South West Africa and the North-Western Cape. This is causing concern, especially in view of the problems already being experienced with this species in the USA and Mexico.

The three-thorn rhigozum *Rhigozum trichotomum* is also still spreading, especially on the deeper sandy soils in the south of South West Africa, the North-Western Cape and parts of the Free State. No effective control measures against this species are known as yet.

Bush encroachment is becoming more and more of a problem in the Karroo Region. The favourable weather conditions have aggravated the problem, especially in parts that are badly denuded or have lost the original vegetation. In the mountainous eastern parts of the Karroo Region especially, bush encroachment at the expense of valuable and productive natural bush and grass pastures is becoming more and more of a problem.

By far the most important of the invader bushes are the three shiny leaved species *Rhus* spp., ystertop *Dodonaea viscosa*, resin bush *Euryops* spp., rhenoster bush *Elytropappus rhinocerotis* and others such as ouhout *Leucosidea sericea*. The sweet thorn *Acacia karoo* is a serious threat next to rivers and in flood-plains as well as in the undulating terrain of the Eastern Karroo.

In the sweet bushveld parts of the Transvaal the following invader plants are posing a great threat:

Acacia mellifera (swarthaak)
A. tortillis (umbrella thorn)
A. erubescens (geelhaak)
Dichrostachys cinerea (sickle bush)
Combretum apiculatum (bush willow)

In the sandy parts of the Waterberg area the following plants are responsible for the encroachment problem:

Terminalia sericea (sandgeelhout)
Burkea africana (wild syringa)

VELD WEEDS

Jointed cactus

The aim of the jointed cactus programme was to destroy this weed as a serious threat to this country within ten years. We have reached the end of the ten-year programme. Despite the fact that the State has already spent about R7,5 million on spray alone, new infestations are still being discovered and the area of the properties on which jointed cactus occurs is increasing steadily.

A systematic inspection system was started in July 1963. At present there are 1 681 applicants (owners of infested veld) in the inspection area who have applied for free spray or for participation in the programme. This represents an increase of 522 applicants (45 per cent) since 1964.

The total area of all the farms infested with jointed cactus in the inspection area increased from 1 212 157 ha during the first evaluation analysis in June 1964 to 1 637 669 ha in June 1975.

This means that the inspection area has increased by 425 512 ha during the entire period and 6 883 ha during the past year - increases of 35,1 per cent and 0,42 per cent respectively.

During the first evaluation analysis in June 1964, 643 719 ha in the inspection area was classified as infected. This area expanded by 180 623 (28,0 per cent) and at present 824 342 ha or 50 per cent of the total farm area of 1 637 669 ha is infested.

In the course of the inspection tours it was found that 394 196 ha or 61 per cent of the veld that was really infested has already been brought under control. In June 1975, 666 238 ha or 81 per cent of the 824 342 ha actually infested was under control.

It was found in the course of the inspection in June 1964 that only 44 per cent of the persons involved in the control programme were controlling jointed cactus effectively. After repeated inspections and extension the percentage of persons controlling the weed effectively rose to 78 per cent in June 1975, which is an increase of two per cent as against June 1974.

Full-time supervision is one of the most important aspects of the effective control of jointed cactus. However, very few farmers exercise supervision and today it is left almost entirely to the weeds inspector to report to the farmer after his inspection round.

Nassella trichotoma

At present about 1 000 ha of veld in South Africa is severely infested with nassella and it is estimated that 220 000 ha will be affected by the end of the century if the present rate of spread is maintained. Particularly susceptible areas are the Winterberg and Amatola ranges and high-lying mountains and plateaux in the Barkly East and Maclear extension wards.

In April 1975 a meeting was convened at Dohne by the Departmental Weeds Committee and



The troublesome *Opuntia rosea* is estimated to have taken over about 3 000 hectares of veld in the Herbert district

an Action Committee was formed to tackle the nassella problem. Plans were formulated for an immediate publicity campaign to make farmers aware of the threat posed by nassella and a list of research priorities was drawn up. It was proposed that nassella should be declared a noxious weed in order to help prevent the spread of seed as far as possible.

Research to date has shown that nassella can be killed by spraying, although the cost of chemicals alone may be as high as R182/hectare. After spraying, nassella stands regenerate rapidly from seed. Further research is required to devise methods of oversowing to provide effective competition against the nassella seedlings.

In response to the anti-nassella campaign, farmers have hand-cleared some areas of the weed. As eradication of the more severe infestations is beyond the means of the individual, it has been proposed that the State provide weedicides for spray programmes where necessary.

There is no evidence that nassella is present in Natal. Nevertheless, the problems created by this weed have focussed attention on other seemingly undesirable grasses which have similar characteristics to nassella and which are becoming increasingly conspicuous in highland and sub-montane areas. An investigation aimed at identifying these grasses and generally appraising the situation is planned for the coming spring.

Opuntia rosea is the most dangerous weed in the Free State Region. In the Douglas district 1 300 ha is severely infested. The weed was sprayed with

Tordon, but with little success. The cost was very high, viz R156 per hectare.

Imbricate cactus

Farmers do not always realise the threat posed by this weed. The result is unsatisfactory control measures. In all 370 inspections were undertaken on infested farms in the Karoo Region, as against 351 the previous year.

Silver-leaf bitter apple (*satansbos*)

The efficient control of this weed is hampered by the fact that no effective control method can be prescribed. This means that the Department cannot take action against offenders.

A thorough inspection campaign carried out in November 1974 revealed that 4 052 hectares in the Region are infested with silver-leaf bitter apple and only 1 192 hectares can be regarded as being under control. One disturbing aspect is that new infestations are discovered on farms every year. The flood waters of March 1974 were largely responsible for the spread of the weed.

Of the 4 052 hectares in the Karoo Region infested with bitter apple, 3 439 hectares occur in the District of Graaff-Reinet alone. Five farmers in the Kendrew area own 1 665 ha of the 1 667 ha of heavily infested land.

Prickly pear

Since the new prickly pear scheme was started in December 1964, 332 applications (199 in the Eastern Cape Region) to buy spray at R5 per drum for the spraying of prickly pear that had been cut and stacked were received from farmers.

Ouhout *Leucosidea sericea*

Is an indigenous tree of sub-montane areas, particularly cold south-facing slopes. In recent years, probably because of the prevention of intense grass fires, ouhout has invaded fairly large areas of what was originally fairly good grazing land.

In the Kokstad district the tree seems to be adapting itself to better land on warmer northwestern slopes. For this reason farmers in the district are becoming concerned about the tree and are looking for a cheap effective control method. This problem is receiving the attention of the weeds section.

Setaria chevalieri

It is widespread throughout the warmer parts of Natal, particularly from the coastal lowlands to the mist belt. It is a serious plantation weed at Crammond and is developing into a serious plantation weed at Kwa Mbonambi in Zululand.

POISONOUS PLANTS

Gousiekte bush *Pachystigma pygmaeum*

Research at the Zwartrand Research Station

showed that stock losses can be considerably reduced by applying simple rotational grazing systems. In a project where the number of camps and continuous grazing and rotational grazing systems were studied it was striking that over 95 per cent of gousiekte deaths occurred when camps were grazed continuously.

Research at Zwartrand also showed that the gousiekte bush can be successfully eradicated with weedkillers containing fenac. If the plants are sprayed during March and at the beginning of April over 90 per cent of them are killed in the long run. Spraying costs at present amount to about R10 per ha.

PLANT STUDIES

HERBARIUM AND INFORMATION SERVICES

Computerisation

Label data of more than 200 000 plant specimens in the National Herbarium, Pretoria, have been encoded. This represents about half the Southern African holdings in the collection. At the same time work on the computer programmes for the retrieval system continues.

The Institute has recently taken delivery of a Burroughs TD 8000 CRT screen, connected by telephone line to the Departmental computer.

Information

About 25 000 plant specimens were identified and further information was furnished about many of these. A high percentage of the material dealt with was collected during surveys in which the Institute is involved, such as the Nylsvlei Savanna Ecosystem Project.

Many requests for information came from neighbouring countries, from other Institutes of the Department and from firms dealing with weedicides. Twenty-four groups of students were shown over the collections.

Development

Almost 35 000 plant specimens were mounted and about 30 000 have already been incorporated into the various herbaria of the Institute. Quick guides, special identification collections in which every species is represented by a single typical specimen, have now been compiled for almost all groups in the National Herbarium in Pretoria. They are also being introduced at some of the other herbaria as they have proved to be time- and labour-saving.

Fifty new herbarium cabinets were added to the herbarium in Pretoria. Two fumigation chambers were acquired to safeguard the collections against harmful insects which are easily introduced with incoming plant material. A new collectors' label designed with a view to the planned computerisation of all herbarium label data has been printed.



This attractive plant, *Plectranthus oertendahlii*, has been bred in Sweden since 1900 and was recently (in 1971) rediscovered in Natal

South African plant names

About 12 000 scientific names of South African plants, as used at present in the Institute, have been compiled in computer-readable form.

About 2000 names used in recent authoritative works have been abstracted and are being put on index cards for distribution to interested bodies.

South African plants

A series of one-page pamphlets on South African plants is in preparation. The first pamphlets to be published will be on trees and species of economic importance. Each pamphlet will include several illustrations, a distribution map, the most important diagnostic features, a description of the species, a discussion of economic aspects and other features.

FLORA RESEARCH

Flora of Southern Africa

Seven volumes are in the course of preparation.

Vol. 9. Good progress has been made on the genus *Protea*.

Vol. 14. The genus *Crassula* has been completed and a start has been made on the genera *Adromischus* and *Cotyledon*.

Vol. 16. The page proofs of Mimosoideae have been corrected and returned to the Government Printer. Publication of Mimosoideae is expected within a few months. The account of Caesalpinioidae has been completed and edited and is due to go to press shortly.

Vol. 21. Work is still proceeding on *Hermannia* in Sterculiaceae and on Malvaceae.

Vol. 22. This volume has been completed and edited and is due to go to the press.

Vol. 25. Revisions of the genera *Eremia*, *Eremiella*, *Grisebachia*, *Philippia* and the newly described *Stokoeanthus* were completed. Revisions of the genera *Blaeria* and *Sympieza* were started.

Vol. 33. A revision of the South West African species of *Eriocephalus* was completed.

The new flora format has almost been finalised. In future, families or parts of large families will be published separately as soon as they are completed.

Excellent progress has been made in Lamiaceae where the genera *Hemizygia* (28 spp.), *Syncolostemon* (9 spp.) and *Stachys* (41 spp.) have been completed. A start has been made on Onagraceae, Ranunculaceae and the Stapeliaceae (Asclepiadaceae).

Genera of Southern African Flowering Plants

The final proofs of Vol. 1 (Dicotyledons) have been corrected and delivered for printing. Publication of Vol. 1 is expected shortly. With the co-operation of botanists, both within and outside the Botanical Research Institute, Vol. 2 (Monocotyledons) has been completed and the manuscript submitted for publication.



The marsh rose *Orothamnus zeyheri*, indigenous to the Southwestern Cape, had virtually died out, but was saved by the zeal of the Department of Forestry and the Botanical Research Institute.

Anatomy of grasses

The tribe Danthoniaceae was concentrated on. Extensive field collections were made in the winter rainfall area and variation within and among populations was sampled. 400 numbers, mainly of the genera *Merxmüllera*, *Pentaschistis*, *Plagiochloa*, *Lasiochloa* and *Chaetobromus*, were collected. Sections and epidermal scrapes were made of their leafblades which were then photographed, described and coded for computer processing.

In addition, assistance was given to an archaeologist with the microscopic analysis of plant fragments 6 000 to 10 000 years old obtained from excavations in the Namib Desert.

Cytogenetics of *Eragrostis curvula*

A cytogenetic investigation of the *Eragrostis curvula* complex is being undertaken in an attempt to explain the taxonomy of this agamous complex (vegetative asexual type). Researchers are looking for fully sexual types for this purpose; these could be very useful in the future breeding of *E. curvula*. Three hundred and twenty plants of this complex have been collected in Zululand, Natal, the Transkei, the Eastern Cape and the Free State and one fully sexual plant has been found so far.

Cytogenetic work is also being undertaken on *Hermannia*, *Mariscus*, *Eriosema*, *Thunbergia*, *Rubus* and *Lantana*.

Cyperaceae

New insight was gained into this family, which is one of the least known in South African flora. Most representatives of the genus *Mariscus* can now be identified without difficulty. Good progress has been made with researches into the valid names to be applied to taxa in this genus. Four of the taxa collected were previously unknown in South Africa. An identification key; to all taxa of the Bracteosae section of *Ficinia* was compiled. Five new species, one new subspecies and three new varieties were established in this genus.

Cajaneae

Work on the taxonomy of *Eriosema*, one of the six genera comprised by this economically important subtribe of the Leguminosae, is far advanced. Preparatory investigations of other genera such as *Rhynchosia* and *Cajanus* have been undertaken.

Thunbergia

An anatomical study of various plant structures of species of this genus has shown that *Thunbergia* forms a taxonomic natural group. *Thunbergia aurea*, which has hitherto been known in South West Africa and Botswana, also occurs in the Northern Transvaal.

Ochnaceae

A study of the taxonomy and anatomy of

the South African representatives of this family has been completed. The taxonomic section of the work has been adapted in broad outline for inclusion in Flora of Southern Africa.

Pretoria flora

Descriptive identification keys to a further 289 species have been compiled. The draft of the text for almost 1400 species and about 500 illustrations of the 1700 species recorded for the district have been completed.

Bothalia

Volume 11, number 4, went to press in July and Volume 11, number 3, appeared in print in December 1974. Volume 12, number 1, went to press in June 1975. The numbers contained a variety of articles relating to taxonomy, ecology, economic botany and botanical history.

Flowering Plants of Africa

Volume 43, parts 3 and 4, went to press in November 1974 and Volume 43, parts 1 and 2, appeared in print in December 1974. Several overseas botanists contributed to these parts.

Memoirs of the Botanical Survey of South Africa

The second edition of Acocks's "Veld Types of South Africa", with the plant names updated and 104 photographs of veld types included, went to press in September 1974.

Liaison Officer, Kew, England

Numerous queries relating to problems in the identification and classification of South African plants were investigated. Queries were received from the National Herbarium in Pretoria and regional herbaria of the Institute, and from the Universities of Cape Town, Natal, Potchefstroom, Rhodes, Stellenbosch and the Witwatersrand.

During the annual Open Day at the Royal Botanic Gardens an exhibit was staged on Restionaceae in South Africa. Living material was collected by the Botanical Research Unit in Stellenbosch and flown to England for the exhibit.

BOTANICAL SURVEYS

Transvaal Bushveld

(a) General planning of the ecosystem pilot study -

A pilot study was carried out during the past year. It started with a series of surveys of the soils, vegetation and fauna of the study area. A simple linear model was built by using available information on the average biomass values and expected average energy flow rates between components.

The individual projects carried out during the past year in the course of the pilot study included a study of the micro- and macroclimate, a survey of soil moisture regimes, the measurement of the topsoil production rates and a study of the photosynthetic properties of plants. The pilot study also included studies of biomass, nutrition and movements of mammals, insects and soil arthropoda, as well as a determination of the seasonal toxicity of *Dichapetalum cymosum*, a poisonous plant that controls the grazing pattern of stock.

(b) Woody plant production : Ecosystem study

Biomass determinations of woody plants were undertaken. Extensive pilot work involved the final determination of appropriate methods of measuring particular tree production rates over short intervals.

(c) Nylsvlei Nature Reserve

The vegetation survey of the 3200 ha farm Nylsvlei, initiated last year, was completed. A Braun-Blanquet phytosociological study was undertaken so as to form part of the countrywide vegetation inventory of permanently conserved areas. A report describing the vegetation and habitat, with phytosociological tables and a map of the communities, is in press.

(d) Western Transvaal sourish mixed bushveld

A study of about 10000 km² of Acocks's Veld Type 19, extending from Rustenburg westwards to the Botswana border, was begun. The survey, which aims to classify the vegetation hierarchically according to the Braun-Blanquet method as a basis for development planning and conservation in this little-known vegetation type, will last several years.

(e) Langjan Nature Reserve

A semi-detailed survey by the Braun-Blanquet method has been carried out on Langjan Nature Reserve within Acocks's Veld Type 14, the arid sweet bushveld in the northern Transvaal. The field phase of the project has been completed. To date, a total of 385 plant species, representing 66 families, have been identified and 3 major plant communities, on sand, calcrete and river banks have been distinguished.

Fynbos

(a) Cape Hangklip area

This project has been completed. The provisional check list for the area which occupies 240 km² consists of 110 families made up of 430 genera represented by 1387 species. Comparisons



A scene in the Langjan Nature Reserve in the Northern Transvaal. The veld in the foreground is Marula sandveld. In the background is the Soutpansberg Range. A semi-detailed botanical survey of the Reserve has been made by the Botanical Research Institute

were made with the floras of the Cape Peninsula and of Natal. The five commonest families, on the basis of their number of constituent species were found to be Compositae, Ericaceae, Leguminosae, Iridaceae and Restionaceae. *Erica* was the largest genus, comprising 96 species.

The vegetation was subdivided into communities using the Braun-Blanquet table method. Twenty-nine coastal plain and mountain fynbos and forest communities were proposed. The communities were related to habitat factors.

Some of the information gained from this project was incorporated into the Department of Forestry's management plans for the Kogelberg State Forest.

(b) *Orothamnus zeyheri*

After recent burning treatments in the Kogelberg, this mountainous area was thoroughly searched and two small colonies of *Orothamnus* were rediscovered in areas where the plants must have occurred previously, but dried out owing to suppression following long protection from fire. This is confirmation of the fact that the seeds of this rare Proteaceous plant can remain dormant in the soil for 20 to 30 years and only germinate after the heat stimulus of a fire.

Vlei rats and a fungus, thought to be a *Phytophthora* species, are continuing to damage regenerating colonies. Control and preventive measures are being applied.

Growth measurements, phenological observations and monitoring of population fluctuations are continuing.

South-Eastern Orange Free State *Interaction between the habitat and a number of grass communities in the South-Eastern Orange Free State*

The investigation of plant habitat relations in which the results were used for the compilation of grazing use classifications for the various soil types was completed during the year under review. According to this study the factors that have the most important influence on pasture development and composition are those that have an influence on the soil moisture status.

The interaction between factors such as topography, texture, slope, degree of erosion, effective depth, climate and biotic disturbance determines the various moisture regimes that influence the development and floristic changes in the pasture types furing overgrazing or after withdrawal of livestock. The criteria for the

compilation of the use classifications of the various soil types studied (forms and general land classes) are accordingly based on these factors.

Zululand

Vegetation survey of the Zululand coastal dunes

This project involved reconnaissance of the area from Kosi Bay to the Tugela and more detailed surveys between Richard's Bay and the mouth of the Umfolozi River. Braun-Blanquet plots, plant collections (approx. 2 000 specimens) as well as transects were made. They showed a high species diversity with complex space and time structuration.

VELD TYPES OF SOUTH AFRICA

The revision of the Karoid veld types is almost complete. The vegetation will be described with the help of tables showing the frequency of occurrence of each of the 6 748 species in the 83 veld types and variations recognised, and a code of symbols will indicate the habit of the plant - whether it is palatable, ungrazable or poisonous and its successional status and habitat preference. The text accompanying the table will briefly discuss each veld type, drawing attention to its salient features.

Eichhornia Crassipes

Ecophysiological studies conducted on *Eichhornia crassipes* (water hyacinth) under controlled laboratory conditions and in the field have indicated that nitrate is the primary growth limiting nutrient, followed by phosphate, and that ammonium does not serve as an alternative nitrogen source. Studies of hyacinth community structure have shown that there are differences in growth form and chemical composition of plants found at the centres and margins of communities.

Salvinia Molesta

During 1974 and 1975 excellent co-operation continued between the Botanical Research Institute and the Republic of Botswana on the problem of *Salvinia molesta* along the border between Eastern Caprivi and Botswana. An inter-governmental survey, following on the previous 1972 joint South Africa-Botswana survey, was carried out during February 1975 to determine the recent spread of the aquatic weed.

The survey verified the November 1974 report of *Salvinia* in the Kwando River which means that there has been a jump of over 100 km from the nearest previously known source of *Salvinia*. Despite the strenuous control measures adopted by both Botswana and Eastern Caprivi authorities since November 1974, this new source of spread raises the strong possibility that the whole of the Linyanti and lower Kwando Rivers and swamplands will become infested by *Salvinia* and

that *Salvinia* may be even closer to the Okavango Swamps.

It was also established that another notorious aquatic weed, *Pistia stratiotes*, the Nile cabbage or water lettuce, is present in considerable quantities in the Upper Chobe River and very locally in the western part of Lake Liambezi.

During April and June the South African and Botswana authorities then undertook an extensive pilot aerial spraying project in the Linyanti swamps and on Lake Liambezi. The project necessitated the use of a helicopter to cope with the peculiar problems of spraying *Salvinia* in the swamplands. The project was designed to control as far as possible the further western spread of *Salvinia* in the Linyanti swamps, and at the same time to establish the most effective means of herbicidal application under the various swamp and lake conditions, as well as to assess the overall ecological effects of the herbicide.

EARTH RESOURCES TECHNOLOGY SATELLITE - LANDSAT-2

Previous successful trials by Botanical Survey staff showed that the satellite imagery from ERTS-1 could be used to obtain vegetational and ecological information quickly - information of a kind that it is not normally possible to obtain by more conventional methods. This has resulted in further co-operation between the United States and South Africa, with the appointment by the National Aeronautics and Space Administration of an officer of the Botanical Research Institute as principal investigator for a project aimed at monitoring the occurrence of veld fires in South Africa and relating the occurrence of veld fires to ecology, veld type and veld management. Data are being obtained from the second earth resources technology satellite, Landsat-2, which was launched in January 1975.

The project was the only one accepted from South Africa by NASA. It will monitor the occurrence of fires and will make this information available to the rest of the Department of Agricultural Technical Services and to other state departments to assist in the better control and development of veld management practices.

The Botanical Research Institute is continuing to co-operate with the CSIR in the use of satellite imagery.

CO-OPERATION WITH OTHER ORGANISATIONS National Conservation Plan

A start has been made on the Institute's contribution to the National Conservation Plan. The Institute will serve as a clearing house for relevant data and it will store and process these data and present the results and conclusions. Preliminary findings have been drawn up and presented in respect of the Pretoria-Witwatersrand-Vereeniging Complex and Region 26 (Eastern Transvaal) of the National

Physical Development Plan of the Department of Planning.

Soils and Irrigation Research Institute

The Institute is collaborating with the Soils and Irrigation Research Institute in the mapping of climates as part of a programme to identify pedosystem-climate units of similar production potential.

ECONOMIC BOTANY

Cancer research

Screening of South African plants for activity against cancer is continuing. Over 2000 samples have now been sent to the U.S.A. for initial screening. Bulk collections of a number of active species have been supplied and intensive clinical trials on *Putterlickia verrucosa* from the coast of Natal are continuing.

Paleo- and ethno-botany

Plant remains from a number of archaeological sites were identified, most notable of which is Border Cave in the Lebombo Mountains which has yielded exciting information on early man. A comparative collection of plants used by primitive peoples is being assembled and used as an aid to the identification of plant remains.

Nassella trichotoma

Nassella trichotoma is continuing to spread in the Eastern Cape and several new infestations have been discovered. A detailed evaluation of methods of controlling this dangerous tussock grass has been made and mechanical and chemical control methods are now being tested by the regions. Afforestation offers the best hope of smothering the regeneration of *Nassella* seedlings.

More information about *Nassella* and its control will be gathered via investigations in its native South America, as well as in Australia, Tasmania and New Zealand, where it is a troublesome invader.

Other alien invaders

A survey of both terrestrial and water weeds has been started in the Transvaal. The survey is designed to yield basic information about the distribution and characteristics of weed species.

Genetic erosion

A programme to collect and preserve living material of threatened plant species has been started. The plants that are being collected include the progenitors of cultivated crop species, as well as indigenous species threatened with extinction in the veld. Collection techniques to be applied in this project were tried out in the Eastern Caprivi.

Survival studies

A book on survival techniques was

completed and published. Much fieldwork was undertaken and more than 1000 colour slides of edible and useful plants were added to the main collection. Literature on survival was scanned and useful information extracted and recorded.

Poisonous plants

A field investigation service into serious cases of stock-poisoning was provided. The collection of basic data on poisonous plants continued. The data will be computerised and eventually it may be possible to establish "poison centres" as in the U.S.A., where poisoning can be diagnosed and treatment prescribed.

The text of a book to aid in identifying plants poisonous to stock was amplified with toxicological data, and the preparation of a book on plants poisonous to man has been started.

PRETORIA NATIONAL BOTANIC GARDEN

General

The general plan for the Pretoria National Botanic Garden is now in the last phases of execution. Most of the road system has been laid out but many of the roads have not yet been given a hard surface.

The ecology subdivision was given its final form after several adjustments during the year under review.

Special attention was given to the entrances and the garden will soon present a more attractive appearance to the outside world. Thanks to a special donation a second wrought iron gate was designed and built by the well-known artist Hans Brugger; the artist's subject was mainly aloes and other succulents.

The object is to develop a garden in which the emphasis falls on walking. The service roads have therefore been so designed that they can be used as footpaths, and more footpaths are being built through the rockier parts. About 15 km of service roads and footpaths will be created eventually; they will take the walker to the great variety of vegetation the various ecological divisions offer.

The consolidation of plant beds has been continued and has reduced the maintenance problem. Plants that can serve as ground cover have been grown on a large scale with a view to controlling weeds and reducing maintenance costs. Twenty-seven thousand plants were transplanted for this purpose during the year.

New developments

The ecological area that will represent the forests of South Africa was given particular attention. For this purpose an area that represented a general tree collection was redesigned and a new road layout and irrigation system was introduced. The original planting, which represented 400 species, was extended by the planting of another 75 species which were grown for this purpose in the nursery. The new forest area was especially suitable



! The Reynolds gate at the main entrance to the National Gardens in Pretoria. The gate was erected to the memory of the aloe expert, Dr G.W. Reynolds, and was designed by Hans Brugger

because the present plantings, which consist of bigger trees, offer protection to the more frost-sensitive species that were added.

A new parking ground for visitors next to the pedestrian entrance was completed.

Nursery

The reorganisation of the nursery in accordance with the new plan was continued. All the shade houses were equipped with plant tables. A general sorting of plants was started in order to fit in with the division of shade houses into units with similar growing conditions.

In the nursery collection there are about 10 000 plants in pots at present, representing over 1 500 species.

With a view to improving propagation by means of cuttings a trial was carried out to determine the best combinations of temperature, air and soil, light and moisture for rooting cuttings of winter rainfall and summer rainfall plants.

Plant records

A survey of all plants in the nursery was completed. This survey was essential in order to sort the plants according to their growth requirements, and laid the foundation for the reorganisation of the nursery on this principle.

680 new collections, representative of about 500 species, were added to the nursery.

The labelling of plants in the garden is still a major cause of concern because of the actions of the public. The special type of labels and the new method of implanting them make it extremely difficult to damage or remove them. This method of labelling is very time-consuming but is essential.

Two sections containing over 1 000 collections in all were dealt with and a large proportion of the labels were permanently implanted.

4. Field Husbandry

MAIZE

Breeding and selection

High lysine cultivars

Ten experimental white opaque-2 (high lysine) maize cultivars were evaluated at 13 localities in South Africa in 1974/75 and compared with commercial hybrids of high potential.

Preliminary results obtained from nine of these localities (seven dryland and two irrigation sites) show that in five of these trials opaque-2 hybrids gave the highest yields, which ranged from 5 300 kg to 9 600 kg per hectare. In no trial were the best opaque-2 hybrids significantly outyielded by the best commercial hybrids, namely, PNR 353 and RIE.

The highest yields among opaque-2 hybrids were obtained with two experimental hybrids. In an irrigation trial at Fort Hare, these two hybrids gave yields of 13 100 kg and 12 600 kg per hectare respectively, as compared with a yield of 12 200 kg per hectare obtained with the highest yielding commercial hybrid, RIE. This is an indication of their potential under better conditions.

Although protein and lysine levels have still to be finally evaluated, these results indicate that most of the inherent weaknesses of opaque-2 hybrids have been eliminated and that the first release of this type of hybrid in South Africa can now be considered with confidence.

The results mark a singularly important highlight of the last decade in maize breeding.

Of similar significance is the successful introduction of a new gene for resistance to *Helminthosporium turcicum* leaf blight into outstanding, though locally unadapted, US inbred lines. Some of this improved material has already featured in the best local maize hybrids and has been released to the USA and elsewhere.

Some thirty elite inbred lines and a collection of about 70 varieties and other populations will be released to commercial maize breeders as a result of the work done in the past two years.

Maize cultivar trials (including the administration and interpretation of the trials) will be carried out on a national basis by the Highveld Region from this year onwards.

In order to develop resistance to streak, first generation in-breeding for pure strain development was carried out from resistant sources. A preliminary constitution of hybrids tolerant to streak from known material has been completed and will be evaluated during the coming season.

Good progress was also made with the breeding, selection and constitution of material resistant to one of the following: boil smut, cob-and-tassel smut and *Diplodia* stem rot.

Sweet-corn breeders arrived at a preliminary identification of five hybrids that seem promising with regard to both yield and satisfactory quality for the canning industry.

In the course of an evaluation of the stem strength of a series of planting material planted at various planting densities, a highly significant correlation was obtained between the compression strength and mass of the same 2 cm section of stem of a maize plant.

The national maize cultivar trial was again carried out at the Loskop Research Station. The average yield of the trial was 10 300 kg per ha. The cultivars A471W, PNR 530, Regop 7 and Regop 5 performed from 21 to 28 per cent better than the average for the trials.

In an experiment with a number of commercially available hybrids PNR 353 (8 704 kg/ha), PNR 641 (8 611 kg/ha) and SR 52 (8 009 kg/ha) gave the highest grain yields at the Dundee Research Station, whereas at Cedara SR 52 (8 119 kg/ha), PNR 641 (8 006 kg/ha), PNR 432 (7 073 kg/ha) and PNR 353 (7 059 kg/ha) gave the heaviest yields.

At Cedara maize grown by the no-tillage system gave yields comparable to conventional planted maize. Maize planted into a crop of *Eragrostis* that had been killed with a weedkiller yielded 7 603 kg/ha. Where the maize was planted by the no-tillage method into maize stalks (i.e. second year no-tillage) very high yields of 8 922 kg/ha were achieved.

The results of cultivar trials carried out in the Elliot-Maclear area during the past two years show that SA 60 and PNR 44 are the best cultivars for this area.

Near Dohne the cultivars Regop 1, PNR 353, SR 52 and SA 60 made the best showing during the past three years.

In the coastal areas (Bathurst region) the best cultivar was PNR 95.

Maize cultivars for silage

The revival of interest in milk production in the George area and the consequent enquiries about suitable maize cultivars for silage have led to a maize cultivar/espacement trial being started.

Four cultivars - Pioneer 44, ASA 83, SA 100 and SSM 40 - were planted and four espacement treatments were used.



Trial plantings of various maize cultivars at the Sandvet Research Station

The average green matter yields were as follows, calculated for all spacings (tons/ha):

Pioneer 44	52,40
ASA 83	51,20
SA 100	42,45
SSM 40	42,40

Diseases and pests

The mycology section of the Plant Protection Research Institute conducted surveys to determine the survival of *Helminthosporium maydis* on maize residues and the incidence and geographic distribution of the fungus.

It was found that in the Badfontein area the fungus can survive the winter in the residues of infected plants in the fields and later, under favourable conditions, it forms spores capable of infecting the next crop planted. Hot weather, with good rains followed by hot sunshine, occurred repeatedly during the early part of summer and under these conditions the fungus disappeared from the maize residues within a few weeks. Because the planting of maize was delayed until the end of November the new crop started growing when the inoculum was already exhausted. The Badfontein area was therefore almost free of disease.

Regular inspections of catch plantings of a cultivar that is very susceptible to *Helminthosporium maydis* and that was planted for the purpose of tracing this fungus at Bronkhorstspuit, Middelburg, Belfast, Groblersdal,

Lydenburg, Piet Retief, Ermelo, Bethal and Delmas showed no sign of infection by the fungus.

Sample of maize leaves were submitted from Pietermaritzburg, and *Helminthosporium maydis* was found on several breeding strains. The fungus was strain 0, which is generally regarded as being less destructive.

Helminthosporium maydis was therefore found only on a few volunteer plants of a very susceptible cultivar in the Lydenburg district (strain T), and on a small number of plants of certain breeding strains at Pietermaritzburg (strain 0). It appears from the field surveys that there has been no increase in the distribution and incidence of this fungus.

Ecological investigations of stalk borers in the maize areas have indicated that this insect has a number of natural enemies, including an egg parasite found in South Africa for the first time this year and an unknown fungus that caused high mortality among the stalk borers.

Surveys have also shown that the sorghum borer *Chilo partellus* now occurs over a wider area of the maize triangle. With better adaptation this invader could become a threat to maize crops.

It has been confirmed that thorough ploughing in of maize stubble can prevent harmful outbreaks of maize stalk borer infestation.

A systemic insecticide, carbofuran, which is applied in the planting furrow, provides good control of stalk borer infestation in the earlier stages of growth.

During the past year streak has assumed epidemic proportions in early maize plantings in the North-Western Free State and in other areas. It

was found that infestation more than six weeks after emergence had relatively little effect on grain yields.

The application of the systemic preparation carbofuran appears to hold great promise for complete crop protection.

Surveys have shown that the incidence of nematodes is particularly high in the sandy parts of the North-Western Free State and the Western Transvaal. These nematodes can be a major factor in suppressing yield potential, since they damage roots and carry root rot organisms.

WHEAT

In accordance with a decision of the Small Grain Action Committee provision was made for only two breeding centres for spring wheat in the Republic, namely Stellenbosch in the Winter Rainfall Region and Bethlehem in the Highveld Region.

The evaluation of segregating strains from these two breeding programmes will in future be carried out as follows throughout the Republic:

F ₂	-	Makatini (Winter)
F ₃	-	Bethlehem (Summer)
F ₄	-	George (Winter)
F ₅	-	Bethlehem (Summer)

This will be followed by a complete agronomic evaluation at Bethlehem, Vaalharts, Roodeplaat, Tygerhoek, Langgewens and Elsenburg.

To ensure that new genotypes will meet the requirements of these varying environments in respect of adaptation and resistance to disease, it has become necessary to expand the sources of germ plasm.

Co-operation with additional international nurseries was therefore arranged. These include the international septoria nursery of CIMMYT in Mexico and PAT in Brazil (PROGRAMA ACELERADO DE MELHORAMENTO DO TRIGO): the international stem rust and mildew nursery in the USA, and CIMMYT'S "CROSSING BLOCK", which contains a variety of germ plasm.

In view of the high incidence of *Septoria* and the resistance developed over the years, it appears that South Africa could make a considerable contribution on the international front with regard to the identification and provision of resistant material.

The South African cultivar Skemer, which appears to have a high resistance to *Septoria*, is already in use in Brazil.

To supplement these sources, another 27 strains from the local programme were consigned to Brazil.

In addition to these consignments, 25 strains have already been included in the 1975 international stem rust nursery and an additional 66 were consigned for inclusion in the 1977 nursery. In all 52 breeding strains and standards have been consigned to CIMMYT.

Elite trials

During the 1974 season these trials were carried out at four sites in the Swartland and four in the Rûens areas, and at three sites in the South-Western Districts and one in the Eastern Cape.

The main purpose of the trials was to compare newly bred strains and homogeneous imported strains with standard cultivars.

The strains recommended and accepted for release by the Grading Committee of the Wheat Board in 1974 are the following:

W15 under the name of MEMNON and 68/351 under the name of SONDEREND.

SST 3 and Tosca were the best of the standard cultivars in the trials throughout the entire region. The highest yield from SST 3 was 4 383 kg per ha at Philadelphia and that from Tosca 3 708 kg per ha at Pools.

The progress of the new strains is compared with that of the existing cultivars in the following table. The yields from the cultivars and strains in three subecological areas are given below:

	Philadelphia	Albertinia	Jongensklip
	kg/ha	kg/ha	kg/ha
SST 3	4 063	1 193	1 912
T4	4 427	861	1 049
70/569	3 617	927	1 642
RR 10-71	3 169	969	2 144
RRR 340-72	3 778	1 002	1 688
73/W72	3 430	953	1 769
RRR 326-72	3 395	994	1 826
RRR362-72	3 712	1 020	1 867
71/509	3 939	1 229	1 763
71/512	3 535	1 092	1 977
Ro 74/4	3 844	1 342 (1st)	2 283 (1st)

With regard to yield the strains 71/512 and Ro 74/4 were second and third, respectively, among all the entries (88), in all the localities.

Cultivar trials

During the past season 19 cultivar trials were undertaken in the Winter Rainfall Area. The trials with 25 to 30 entries are being planted in as many subecological areas as possible to ensure that the data from these trials will be available to all producers. The best three cultivars in the lower and higher rainfall areas of the Swartland performed as follows: (According to seed sales in the Swartland the semi-dwarf types, and especially Inia, T4 and SST 3, are becoming very popular.)

Koringberg	SST 3, with 2 805 kg per ha Gamenya, with 2 399 kg per ha Raven, with 2 381 kg per ha
Darling	Janitor, with 1 990 kg per ha Raven, with 1 973 kg per ha SST 3, with 1 865 kg per ha
Malmesbury	SST 3, with 3 611 kg per ha SST 3, with 2 876 kg per ha Inia, with 2 860 kg per ha
Pools (lower rain fall area)	Lee Mida, with 2 550 kg per ha Raven, with 2 445 kg per ha SST 3, with 2 406 kg per ha

The best three cultivars in the parts of the *Rûens* area with relatively high and low rainfalls are indicated below:

<i>Riversdale</i>	Tosca, with 776 kg per ha SST 3, with 755 kg per ha Zambezi, with 752 kg per ha
<i>Swellendam</i>	Ciano, with 1 297 kg per ha Bona, with 1 154 kg per ha Flamex, with 1 126 kg per ha
<i>Protém</i>	SST 3, with 896 kg per ha Ciano, with 663 kg per ha Sonderend, with 620 kg per ha

Thirty cultivars and strains were evaluated at the Outeniqua Experimental Farm. SST 3 performed best and R7-70 and 70/569 were the best of the strains. The newly released Sonderend (68/351) took eighth place on the list and was beaten only by the released cultivars Inia, Tobari, Ciano and SST 3.

The same cultivars and strains were planted in the Mossel Bay area as at Outeniqua. SST 3 and R7-70 did best.

The irrigated wheat trials at Oudtshoorn provided further proof of the high potential of wheat cultivation in this area. Inia performed best of the cultivars, producing 5 151 kg per ha, followed by Raven, with 4 998 kg per ha and Tosca with 4 950 kg per ha.

In the cold areas such as the Upper Langkloof, which has a very much longer growing season than Oudtshoorn itself, Sonderend performed best with 2 365 kg per ha, followed by SST 3 and Inia with 2 343 and 2 230 kg per ha respectively.

The fact that the types that have a short growing season did best is a clear indication that this area had a dry spring, since the cultivars with a long growing season normally do best here.

Highveld - The introduction of a mixograph apparatus with the aid of which breeding strains can be rapidly evaluated for quality is an important step forward in the breeding of wheat with a good baking quality.

A back-crossing programme aimed at transferring the high protein gene of Atlas 66 to Scheepers 69 back-crossing derivatives, which have a high resistance to stem rust, has been started.

Strains in which a resistance to stem rust was developed by back-crossing to Flamex showed high resistance under epidemic conditions in trial plantings at various sites. In some cases better yields were obtained than with the standard strains.

Free State - Experimental work with 18 wheat cultivars has shown that it would be difficult to replace Scheepers 69 as a dryland wheat cultivar for the Central Free State.

A large number of bread wheat, durum wheat and biscuit wheat strains were tested at Vaalharts. Only a few bread wheat strains produced higher grain yields than the cultivar T4. The grain yields from some durum wheat strains were relatively high, and several strains beat the released cultivar Lakota with regard to grain yield.

Natal - Three wheat cultivars were grown at the Kokstad Research Station under irrigation to evaluate planting time, nitrogen levels and yield potential.

Turpin 4 significantly outyielded the other two cultivars with 3 927 kg per ha (12,5 per cent moisture), Zambezi II yielded 3 067 kg per ha and Inia 66 3 035 kg per ha.

The May planting time was shown to be considerably better than the August planting:

	Grain yield kg/ha
May	4 135
August	2 551

A number of wheat cultivars were grown under dryland conditions at the Kokstad Research Station to evaluate planting time and yield potential. May, June and July plantings were established at seeding rates of 20, 30 and 40 kg per ha respectively. Planting time appeared to have little effect on yield.

At the Dundee Research Station low autumn rains resulted in unfavourable conditions for dryland wheat production. Nevertheless the cultivar trials confirmed previous findings that the most promising commercial cultivars for dryland production were Frisko, Heemraad, Kenya, Sökkies, K20 and Bella.

Eastern Cape - Trials carried out with wheat cultivars in the various production areas of the Eastern Cape during the past three years have shown that Zambezi II, Tosca and Inia 66 did best in all the inland areas. In the coastal areas Inia 66 and Janitor were the best cultivars.

Bread wheat

Four bread wheat trials were carried out at 13 sites in the Republic, South West Africa, Mozambique and Swaziland. Six of the 88 strains evaluated were selected for further evaluation in an elite bread wheat trial. Ten strains and cultivars that appeared to be very well adapted to the area were selected for Mozambique and 10 for Owambo. This material was included in bread wheat elite trials and sent to those areas.

It was established that the cultivar T4 is very well adapted in Southern Mozambique.

The production potential of four cultivars and two strains after grazing at various stages of development was investigated at the Outeniqua Experimental Farm. Green matter yields were determined at the tillering, piping and flowering stages, and the grain yield from the control (uncut half of each plot) was determined.

At the tillering stage the strain 68/506

produced the highest green matter yield (6,41 tons per ha). The yields of the other entries all varied between 4 and 5 tons.

The strains 68/506 and Raven produced over 15 tons per ha in the piping stage; K20 was the worst entry at this stage, producing 9,25 tons per ha.

Green matter yields at the flowering stage varied between 11 tons (Lee Mida) and 24 tons (the strain 68/156).

Grain yields were reduced to virtually zero by grazing at the flowering stage, and grazing at the piping stage reduced the yields to uneconomically low levels.

Tosca (15,9 bags per ha) performed best of the recognised cultivars after grazing at the tillering stage. The control Tosca produced 19,8 bags per ha. Lee Mida's yield was not seriously affected by grazing at this stage either (15,1 as against 17,5). The best performance was that of the strain 68/506, which yielded 16,3 bags as against 17,5 bags from the untreated section.

With the right cultivar this practice could provide grazing in times of crisis, without a very big reduction in the grain yield.

Planting methods

An espacement and planting density trial at Vaalharts and Sand-Vet clearly showed that the following is the ideal planting method for wheat under irrigation:

- (1) Row espacement between rows - 15 to 30 cm
- (2) Planting density - 80 kg of seed per ha and upwards.

Fertilising

Several nitrogen fertilising trials with wheat have shown the following results:

1. The ideal nitrogen level for Vaalharts on the Hutton Form, Mangano Series, for the cultivar T4 is 120 to 155 kg of nitrogen per ha.
2. On soils of the Hutton Form, Schorrocks Series, at Sand-Vet the ideal level of nitrogen is 80 to 110 kg per ha.
3. Under irrigation at Glen, on the Hutton Form, Mangano Series (heavier phase), the ideal level is 100 to 130 kg of nitrogen per ha.

The ideal level of nitrogen at Glen for the cultivar T4 under irrigation is 110 kg per ha.

Weed control

The new preparation for the control of wild oats in wheat, Difenzoquat, was tested under controlled climatic conditions. With regard to phytotoxicity, it was found that the preparation is harmful to wheat growing in conditions of moisture stress.

In field trials the preparation benzoylpropethyl proved to be an effective and safe product for controlling wild oats in wheat. Despite this finding, the use of this preparation is uneconomic in areas where the yield potential is

under a metric ton of wheat per ha, because the price of the preparation is high.

A safe preparation for controlling rye grass (*Lolium* spp.) in wheat has been identified for the first time. The weed is becoming a problem, especially in the Rûens and George/Mossel Bay areas. The preparation (HOE 23408) also controls wild oats and appears to be safe for lupins and peas.

Methazole was tested as a herbicide for wheat and peas. Pre-emergence treatment for peas and post-emergence treatment for wheat appear promising. Good control of broad-leaved weeds, especially mat sandburr, has been obtained with this preparation.

Plant diseases

Good progress has been made with the evaluation of the resistance of a large number of South African and overseas wheat cultivars and strains to stem rust, leaf rust, powdery mildew, *Septoria nodorum* (glume blotch) and stunt (virus streak). Results have been collected from seven localities and more reliable background information can now be given on breeding, agronomic evaluation and extension programmes.

The extent of root diseases (caused chiefly by *Rhizoctonia* and *Fusarium* spp. on the Springbok Flats) is causing concern, as is the fact that the chief wheat cultivar grown on the Springbok Flats, Inia 66, is becoming more and more subject to attacks of rust.

OATS

Breeding At the Langgewens and Tygerhoek Experimental Farms trials were planted at various times in order to identify material that is widely adaptable with regard to planting time. Genotypes with this wide adaptability were found. The cultivar Perdeberg (Florida 501) showed this adaptability at Langgewens and Tygerhoek.

Suitable oat cultivars for the production of seed, silage or grazing have to be made available to the industry continuously. With this object in view the Elite oat trials, which were carried out at 9 places, were continued in 1974.

Commanche, an imported strain, performed very well in the Rûens and the South-Western Districts and produced a yield of 1 439 kg per ha at Napier. (Heros produced 1 223 kg per ha.) This strain was released for the Rûens area under the name of Overberg.

In the Swartland area another imported strain, F/A 501, produced consistently high yields. In 1974 this strain was first at Darling and Langgewens with seed yields of 3 613 and 4 201 kg per ha respectively. This strain was released for the Swartland area under the name of Perdeberg. The yields from Perdeberg were 3 616 kg in the Malmesbury district and 4 201 kg in the Darling district, as against 3 320 and 3 584 kg per ha respectively from Heros.

Oats for grazing - Grazing trials with oats were carried out with 11 entries at the Outeniqua

Experimental Farm and in the District of Mossel Bay. Half the plants were cut to determine their grazing potential, and the other half were left for seed production.

H66/91, Heros and Nora, which produced over 14,5 tons of green matter per ha from four cuttings, did best at Mossel Bay, where the average of the trial was 13,25 tons per ha; the worst entry was Alaska (11,15 tons per ha).

At Outeniqua Heros (22,9 tons per ha) and H66/91 (21,7 tons per ha) also performed best in a trial where the average green matter yield was 20,27 tons per ha. Jongensklip was the poorest entry (18,75 tons per ha).

At Mossel Bay Ora performed best with regard to seed yield (22,3 bags per ha), followed by H66/91 (16,1 bags per ha) and Heros (15,6 bags per ha). The worst cultivar was H66/135 with 4,8 bags per ha. At Outeniqua, on the other hand, H66/135 produced 29,4 bags per ha, whereas Heros, which was second, produced only 18,7 bags per ha. Jongensklip (6,4 bags per ha) came last in this trial.

At the Vaalharts Research Station 150 oat strains from various sources were evaluated. Several seemed promising in respect of both grain and hay production.

The cultivar Alaska made the best showing in a cultivar trial held at Vaalharts and Sand-Vet with 17 entries.

BARLEY

The trial under irrigation at Oudtshoorn yielded 4,218 tons per ha, which proves that barley would do well under irrigation in this area.

Because of its good brewing quality and yield Clipper was made available to the trade as a new cultivar.

Yields from this cultivar compare well with yields from Swanneck, as the following figures show:

	Langgewens	Rietpoel	Tygerhoek
	kg/ha	kg/ha	kg/ha
Clipper	2 542	3 026	3 343
Swanneck	1 210	2 723	2 446

The strain 60/19/58 was withdrawn from commercial multiplication, but the strain 60/19/30A may be considered for release during the coming year, depending on the verdict of the brewery on the brewing quality.

Swanneck was treated with various insecticides and fungicides in a trial. No differences in the yield were observed. The preparations had no effect on the percentage of plump grains or the hectolitre mass either. All the treatments were graded as Grade B1, chiefly because of a very high percentage of plump grains.

High nitrogen fertilising raised the yield a little, but had a somewhat adverse effect on the plump grain percentage.

Quality analyses showed the following results:

(1) Wetting during grain filling and harvesting reduced the nitrogen percentage, whereas lodging increased the nitrogen in the grain.

(2) Lodging raised the protein content of the barley by increasing the nitrogen percentage.

(3) The increased nitrogen percentage and increased protein content brought about by lodging had an adverse effect on the brewing extract and consequently on the quality of the barley.

All 175 barley strains tested under irrigation at Vaalharts lodged at the high fertilising level and grain production was relatively low.

At present, therefore, barley production at Vaalharts has no advantages and cannot compete with wheat production.

Research again showed that the Fish River Valley has a good potential for the production of brewers' barley.

RYE

An Elite rye trial was carried out on the farm Droëfontein at Langebaan Road in 1974. The entries consisted of 3 standards and 17 strains.

The average yield of 1,48 metric tons per ha indicates that very favourable conditions prevailed in this area.

Eleven strains did better than the standard cultivars Maroc and Weser, which are grown commercially at present. The strains Family-1 and Family-2 performed best.

BUCKWHEAT

Eighteen imported cultivars and some buckwheat seed obtained from Middelburg (Tvl) and Bethlehem were evaluated in a cultivar trial at the Nooitgedacht Research Station at Ermelo. One imported cultivar which grew as tall as the tall South African buckwheat, but was considerably earlier, produced a grain yield of 5,4 tons per ha, as against a yield of 3,3 tons per ha from the local cultivar. These are very high yields - most overseas trials yield no more than 1,5 to 2,0 tons per ha.

A number of other cultivars which are considerably lower growing and therefore less inclined to lodge were much earlier (70 days) than the local buckwheat and ripened more evenly, while producing grain yields of about 3 tons. Certain

certain cultivars, a few of which produced grain of an excellent quality, were not adapted at all and produced considerably lower yields.

GRAIN SORGHUM

Thirteen grain sorghum cultivars were grown at the Kokstad Research Station to measure grain yields.

The grain yields (12,5 per cent moisture) varied from 8 568 kg per ha to 4 706 kg per ha. The highest yield was obtained from the hybrid SSK 2.

The yields are very encouraging. This crop could be an alternative to maize, especially in the drier regions. With a higher digestible crude protein content (9,2 per cent) than maize, grain sorghum could become an important animal feed.

Grain sorghum is still harvested mainly by hand, but a rapid change-over to mechanical harvesting is taking place.



Entomologists breeding potato moths artificially

LUPINS

The chief aim of the lupin breeding programme is to evaluate all present populations of *Lupinus angustifolius* with regard to their mildew infection status, and determine the alkaloid status of the mutated *Lupinus mutabilis* strains with the aid of sophisticated laboratory techniques.

Various lupin species were grown at the Kokstad Research Station to evaluate their adaptability to the area.

From the results it seems that with a yield potential of 3 000 kg per ha lupins could form an extremely valuable source of protein for livestock in this part of Natal.

Weed control - The investigation into the practicability of the pre-emergence application of weedkillers to lupins to control a wide range of weed was continued. Excellent weed control, and consequently increases of over 100 per cent in the yield, was obtained with low doses of atrazine and simazine. The costs are expected to be about R2,50 per ha.

These findings have aroused the interest of several chemical companies and simazine is expected to be registered for use on lupins shortly.

The use of simazine will fit in particularly well with the cultivation of sweet lupins, which are not grazed. *Avena*, *Lolium* and *Bromus* spp. in particular are easily controlled with this preparation.

POTATOES

Breeding and selection

About 30 overseas cultivars were evaluated and cultivars such as Astrid (74 tons per ha), Desiree (67 tons per ha), Baraka (65 tons per ha) and Bison (58 tons per ha) performed far better than Up-to-Date (34 tons per ha). All these cultivars therefore yielded almost twice as much as Up-to-Date. Their resistance to virus diseases and late blight was also very much higher than that of

Up-to-Date. Although these are yellow-fleshed cultivars, they appear to have great potential.

Four new cultivars bred by the Department, viz R100, Koos Smit, Sabie and Late Harvest, have just been released. These cultivars were bred by Dr J.E. van der Plank and have been included for evaluation in the current cultivar trials.

The cultivar R100 is suitable for crisp making, and Late Harvest, a late variety, produces high yields of good quality potatoes.

Koos Smit is an early variety, but nevertheless produces high yields with a good quality.

These cultivars are being multiplied at present and should be available for commercial planting within the next two years.

Excellent tuber yields were obtained in an irrigation trial at Cedara. The variety Sackfiller gave the highest yield of 64 tons per ha, but its tuber quality is inferior to that of some of the other cultivars tested.

The new variety Koos Smit yielded 57 tons per ha and the tubers are of good quality. Its yields compared very favourably with those of the popular "all purpose" cultivar BP1, which gave 50 tons per ha.

In a related experiment the effect of moisture stress on tuber yield was investigated. It was found that one day's drought stress (13 hours) resulted in a yield reduction of 3,7 per cent.

In the Winter Rainfall Region there is a demand for table potatoes that can be marketed in October. Winter production in the frost-free areas of the region is the only way to meet this demand. In co-operation with the National Potato Working Team at Rooodeplaar the Region launched a programme for the evaluation of breeding strains in order to obtain a winter potato for these parts. Trials were conducted in the vicinity of Eendekuil and at the Outeniqua and Welgevallen Experimental Farms with 40 new selections and strains.

As a result of the high rainfall, conditions were very wet and no high yields were obtained. Sixteen of the 40 strains were retained for further evaluation on the grounds of their yields and resistance to viruses and late blight *P. infestans*.

In a summer planting (end of October) at the Outeniqua Experimental Farm the cultivars Hydra and Astrid produced the best yields - 2 198 and 2 140 pockets of 15 kg each per ha respectively.

Ilam Hardy also performed well in this planting and produced 1 679 pockets as against 1 452 pockets in the autumn planting.

BP1, the other common cultivar for this area, came fifth from the bottom in this trial, producing 1 260 pockets per ha. Regale, which produced 667 pockets, was the poorest entry.

Quality and keeping quality

A survey on the Highveld revealed that over 70 per cent of all tubers that are mechanically harvested and graded are damaged to a greater or lesser degree. Mechanical damage promotes certain tuber diseases, frequently causes the collapse of

tubers within a few days of packing and is often the reason for downgrading and lower market prices.

The keeping quality of damaged tubers can be considerably improved if they are washed in chlorinated water.

Calcium nutrition affects the inherent resistance of the tubers to rot. Soils with a low calcium content - generally acid soils - produce tubers that collapse more easily during storage.

The application of too much nitrogen has an adverse effect on skin formation and keeping quality.

Where there is a shortage of oxygen, i.e. under waterlogged conditions, thin skins are formed which easily become loose when the tubers are handled. Sufficient oxygen (well-aerated soils) increases the yield and the dry matter content of the tubers.

Where potatoes are earthed up too high the dry matter content is lower and skin damage occurs more readily.

High soil temperatures also have an adverse effect on the quality and the keeping quality. For instance, there is a significant correlation between high soil temperatures and the incidence of internal brown spot. Potatoes should therefore be grown on sandy soils of the lighter type.

Fertilising

Thirty-three fertilising trials were conducted by the National Potato Working Team and the chief findings are as follows:

The quantities of nitrogen required are determined largely by the quantity of available moisture, planting times and plant population.

The picture for phosphate is more complicated and the phosphate content of the soil should be taken into account.

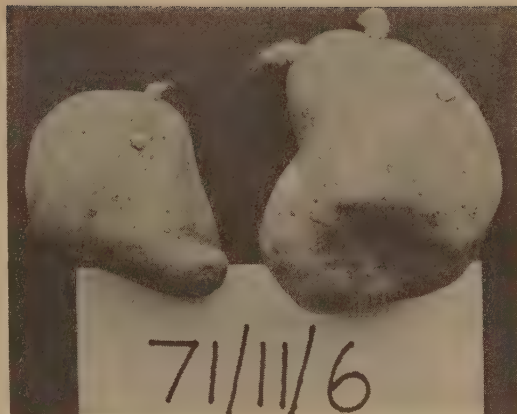
There was no fixed pattern for potassium fertilising. The potatoes showed little response to high potassium fertilising and in certain cases yields were even suppressed.

Diseases and Pests

Jelly-end rot and *Fusarium* wilt

The effect of a wide range of cultural practices on the incidence of *Fusarium* wilt, jelly-end rot and most other tuber-borne diseases and pests is now familiar after four years of extensive field trials, field observations and observations of a variety of other trials.

On the basis of this information recommendations that will enable farmers to control these diseases economically and effectively, using simple and practical methods, can now be made. Some of these diseases can be brought under almost complete control merely by applying one or two simple cultural practices or, in many cases, simply by modifying a cultural practice slightly.



This strain shows the ideal seed potato - short, sturdy shoots with the tubers in excellent condition

Late blight

The late blight forecasting service that was introduced in 1970 has now become an integral part of potato growing in the Highveld. Potato farmers are using this service to an increasing extent, especially farmers who carry out aerial spraying. The value of the service lies chiefly in the fact that production costs are cut considerably because all unnecessary spraying is eliminated and the diseases are correctly and effectively controlled.

Rhizoctonia

Trials have shown that suitable non-mercuric preparations for the treatment of tubers against *Rhizoctonia* are available. Although all these preparations have to be applied at at least 10 times the concentration of the mercuric preparations for effective control, they have no harmful effects on the growth and yield of subsequent plantings. It is important to treat tubers *before* sprouting, however, since treatment after sprouting can reduce the yield.

Anthracnose Colletotrichum atramentarium

Trials have shown that suitable non-mercuric preparations against the anthracnose fungus are also available. It is encouraging to note that the preparations that gave the best control here were also very efficacious against *Rhizoctonia* - which makes it possible to kill two birds with one stone.

Virus diseases

Two cultivars, viz R100 and Sackfiller, were virus-purified by the Plant Protection Research Institute at the Quarantine Station at Stellenbosch by means of heat treatment and tissue cultures. These cultivars were indexed before and after acceptance for the entry phase of the Sabie/Lydenburg Foundation Seed Potato Scheme and found to be free of viruses.

So far it has not been possible to obtain

virus-free planting material from the cultivars 890/20 and Elsa. Both cultivars are intended for acceptance for the entry phase.

The cultivars in the production phase of the Sabie/Lydenburg Foundation Seed Potato Scheme are maintaining their virus-free status in respect of the most important sap-transmissible viruses.

Potato cyst nematodes

A rotational cropping trial conducted over three seasons with non-hosts of this nematode reduced the number of infectious second stage larvae in the soil by 98 per cent. A potato planting during the fourth season did not increase the small number of nematodes that remained and produced a yield of 898 x 15 kg units.

Allowing infested soil to lie fallow produced a drop of 80 per cent in the population density after a year and 95 per cent after 15 months.

Lesion nematodes and stubby root nematodes

In the case of maize the presence of large numbers of the plant-parasitic genera *Pratylenchus* and *Trichodorus* caused the root mass to drop by 48 per cent and the stem diameter by 28 per cent.

Root-knot nematodes

A light infestation causes no perceptible symptoms in potatoes when the tubers are examined immediately after harvesting, but after about 2 months the characteristic thickenings start appearing.

Excellent control of aphids in seed potato plantings in the Winter Rainfall Region was obtained by means of a weekly aerial spraying with metamidophos. Virus control was not so successful, on the other hand, which indicates that aphid control is not always related to virus control.

TOBACCO

The tobacco industry is still experiencing difficulties with rapidly rising production costs and increasing labour problems. Loose-leaf marketing of flue-cured tobacco, which will come into operation in 1977, will relieve the labour and cost problem considerably, but serious attention will also have to be given to mechanisation and other labour and cost saving practices.

Breeding and selection

FLUE-CURED TOBACCO

Final proof has been found that resistance to race 2 of the fungus that causes black shank in tobacco is determined by a single dominant gene. Since plants of tobacco cultivars with resistance to race 2 are attacked by race 1 of the same fungus in many tobacco soils, the inheritance of resistance to race 1 was investigated and was found to differ completely from that of resistance to race 2; breeding for resistance to race 2 was made considerably more difficult.

Two tobacco strains - TL33 and TL38 - that

are resistant to both race 1 and race 2 were released for production. A limited quantity of seed was distributed to producers, preference being given to those producers who were hardest hit by black shank in the past.

BURLEY TOBACCO

In 1974 two cultivars, CB31 and CB34, were released for cultivation; selection for disease-resistant Burley strains was continued. A few of the selections are resistant to races 1 and 2 of the black shank virus. This means that Burley breeding strains with resistance to tobacco mosaic virus, powdery mildew and races 1 and 2 of the black shank virus are now available.

AIR-CURED TOBACCO

High-yielding strains with resistance to all three of the most important tobacco diseases were selected. Resistance to race 1 of the black shank virus was transmitted from Maryland 609. Further selection is being applied to increase the degree of resistance to race 1.

Although 70CDL28 is resistant to powdery mildew, tobacco mosaic virus and brown spot and is capable of high production, it produces too high a percentage of light tobacco under certain conditions. Every effort is therefore being made to develop a cultivar that is more suitable for the production of dark, air-cured tobacco and has the necessary resistance to disease.

TURKISH TOBACCO

Work on crosses and selections continued in an attempt to obtain multiple resistance to disease. The selections have already reached an advanced stage and some of them will shortly be tested in the various production areas for yield and quality characteristics. They are resistant to the tobacco mosaic virus, powdery mildew and race 2 of the black shank virus.

Nematode resistance

Strains that already have the characteristics of flue-cured tobacco to a considerable degree remained comparatively free of attacks by the root-knot nematode in heavily infested soil.

Planting methods

FLUE-CURED TOBACCO

Planting methods that give 40 000 and 80 000 plants per ha instead of 20 000 and topping depths that increase leaf numbers per ha to as high as 80 000 were tested. With high plant populations and comparatively low leaf numbers per plant, leaf numbers of 560 000 and 640 000 per ha produced high yields and incomes.

Increased plant populations of deeply topped plants go hand in hand with reduced growing periods and simplified harvesting and grading procedures, *inter alia*. It was also possible to mechanise the preparation of the fields for this type



A fine stand of tobacco, used for seed production

of planting and to apply chemical weed and sucker control.

Production data for leaf tobacco during the past 5 years (million kg)

Year	Flue-cured	Light air-cured	Burley	Dark air-cured	Oriental	Total
1970/71	19,65	2,91	0,72	9,19	0,59	33,06
1971/72	17,97	2,85	1,11	8,60	0,77	31,30
1972/73	16,55	3,08	1,26	8,38	0,76	30,03
1973/74	15,55	2,81	1,45	7,79	0,90	28,50
1974/75 *	18,78	5,20	1,84	6,43	0,84	33,09

* (Estimated)

LIGHT AIR-CURED TOBACCO

An espacement of 100 x 50 cm and a topping treatment aimed at 400 000 leaves per ha produced

a high yield of high quality tobacco. The cultivars GS46 and GS72 showed no difference in their response to the various treatments.

Where deeper topping was applied with the same espacement the plants produced lower leaf numbers per ha and growing periods were shorter, but production was also lower.

DARK AIR-CURED TOBACCO

Wider espacement and relatively deep topping are suitable for dark air-cured tobacco, and the highest leaf number per ha under these conditions, viz 300 000, also produced the highest yield. Doubling the leaf numbers per ha by doubling the plant populations raised the yields considerably, but produced lighter tobacco at the same time.

There are indications that higher plant

populations and leaf numbers per ha, together with a heavy dressing of nitrogenous fertiliser, promote higher yields of dark air-cured tobacco.

TURKISH TOBACCO

Planting methods that raise the plant population but reduce the number of leaves per plant were tested with a view to obtaining more even maturation where whole plant harvesting replaces leaf picking. This procedure promises to save a considerable amount of time and labour, without prejudice to high production and quality.

Harvesting and curing

FLUE-CURED TOBACCO

Good results were obtained where 4, 8 or 16 leaves per picking were harvested. Two leaves per picking did produce good results with the lower half of the leaves on the stem, but results were considerably poorer where all the leaves were harvested in this way.

Possibly the best results will be obtained with combinations of the various methods, such as four picking of two leaves each, followed by one of eight or two of four.

TURKISH TOBACCO

The lowest yield was obtained where plants were cut and cured instead of being picked, strung and cured in the conventional way. However, the conventional method requires the most time and labour. If the lowest 12 leaves are picked and strung and the rest cut and cured as a whole plant, a comparable yield and income per hectare is obtained and the quality of the tobacco produced is satisfactory. This method results in a considerable saving of labour.

Cultural practices

Utilisation of hail-damaged tobacco

The effect of chemical sucker suppressants on the recovery of tobacco by means of sucker growth was investigated. Off-Shoot-T was applied as a sucker suppressant before cutting. Virtually all suckers down to the surface of the soil were killed. Recovery by means of sucker growth was extremely poor and uneven. Sucker growth developed from secondary suckers in most cases or from suckers that appeared from below the surface of the soil. Consequently sucker growth was poor and the yields obtained were considerably lower than the yields from plants not treated with a chemical sucker suppressant beforehand.

Chemical sucker control

Off-Shoot-T, Sprout-Off, Amchem 71-47 and AC 92553 provided good sucker control. Amchem 71-47 and AC 92553 are two new preparations that appear very promising and compare very well with Off-Shoot-T.

Chemical sucker suppressants were also

applied to light air-cured, dark air-cured and Burley tobacco. The trials were destroyed by a hailstorm, however.

Antitranspirants

Hard and soft plants were treated with Mobileaf and compared with plants not treated with this preparation. Two planting times - early in the morning or late in the afternoon - were also investigated.

The biggest single difference between the treatments was the difference between the hard and soft plants. The hard plants gave the best stand. The treatment with Mobileaf had virtually no effect under local conditions. No difference was found between morning and afternoon planting.

Ethrel

Ethrel was applied to tobacco that had been topped at 8 leaves, 12 leaves and 16 leaves, at a dosage of 100 mg per plant. In each case the plants were compared with tobacco that had received no Ethrel.

Where shallow topping was applied (8-leaves) the tobacco had large, coarse leaves and the characteristic yellowing found with Ethrel was not as evident as in the case of tobacco that had been topped higher. Plants with 12 and 16 leaves had leaves of a finer texture and the yellowing was very prominent. The tobacco was damaged by a hailstorm, which made accurate deductions and conclusions more difficult.

Diseases and pests

Black shank

Zoöspores, an important vector of the dreaded black shank virus, were successfully grown on an oat seed nutrient medium. The optimum germination temperature was 30°C. It was also established that the germ tubes of zoöspores of race 2 of the virus grew more rapidly at all the temperatures tested than those of race 1. These findings, together with the fact that the age of the inocula made no difference to the intensity of infection on the breeding material, are of value in the breeding programme.

Field trials with five different cultivars at 14 different sites registered a black shank infection percentage of 91 per cent on A23, as against 5 per cent on a new breeding strain TL33. Indications that there may be differences between artificial infection and natural infection in the field were found.

Angular leaf spot

An easy, rapid and cheap technique which can be used for testing tobacco cultivars for resistance to angular leaf spot has been developed. The same technique is also suitable for the rapid isolation of the pathogenic organism, and the virulence of the pathogen is well maintained.

In an attempt to identify the mechanism of resistance the respiration rate of the pathogenic organism in the sap of several tobacco cultivars and



Bed decay, a disease which causes considerable damage each year due to faulty bed practices

Nicotiana species was determined. Preliminary results indicate that resistance probably depends more on other factors than on the chemical composition of the leaf.

Black root rot

Surveys showed that this disease is the main cause of unsatisfactory growth of tobacco in the field in certain areas.

The treatment of tobacco seedlings with benomyl immediately before transplanting, followed by a treatment in the field, produced promising results.

Viruses

The virus disease of Burley tobacco which infected large tracts of tobacco near Tzaneen during the past season has been identified as one of the potato virus group.

Brown spot

Efforts have been made to find a method of determining resistance by using the germination rate of the spores of the fungus in the sap of tobacco leaves. However, no significant differences could be found between highly susceptible and less susceptible tobacco cultivars with regard to the

germination of the spores in the sap.

Cigarette beetle

Pyrethrum fumigation at a dosage of 3 300 ml per 1 000 m³ is the standard method applied for the control of cigarette beetle in tobacco sheds. This method results in a dense smoke-fog, which is undesirable. If the concentration of pyrethrum is raised and it is mixed in a special formulation so that it can be applied by the ultra-low volume method, the quantity applied (3 300 ml per 1 000 m³) can be reduced to one-fortieth, the smoke-fog virtually eliminated and efficiency still maintained.

Bollworm

Promising results were obtained with a mixture of an ovicide and a contact preparation. If this mixture were registered it would meet a great practical need.

Quality studies

Nicotine and tar studies

The nicotine and tar yield from cigarettes were correlated with several other chemical and physical properties of tobacco. The results are improving the understanding of the relation

between the physical and chemical properties of tobacco, and so making a contribution to an evaluation of tobacco for acceptability.

Maturing green flue-cured tobacco

The treatment of green flue-cured tobacco in a bulk drier has been very successful. Preliminary results show that, apart from improving several properties of this type of tobacco, the method has a notable effect on the price of the tobacco. An increase of over 100 per cent in the initial valuation was registered, without there being any adverse effect on the chemical and physical properties of the tobacco.

Fertilising studies

Nitrogen fertilising times

The trial, which had been in progress for three seasons, was concluded. The results show very clearly that the nitrogen fertilising times for flue-cured tobacco on the Arcadia series are related to the seasons. If a topdressing is applied after transplanting the tobacco, no definite guidelines can be laid down. It would appear that the best practice would be to apply all the nitrogen at planting time and then make adjustments according to the prevailing seasonal conditions in order to correct any deficiencies by means of a nitrogen topdressing.

Aluminium toxicity

Water culture studies have proved beyond doubt that tobacco is sensitive to aluminium toxicity.

Pot trials with soils with a low pH where analysis showed considerable quantities of aluminium have also shown that if the acidity is raised by liming the yield may even be doubled. However, further studies would have to be undertaken to establish whether this is a direct result of the aluminium present or whether other factors are involved.

Soil and plant analyses

The routine analysis division analysed 11 688 plant samples, 1 762 soil samples and 162 water samples during the year under review and in this way made an important contribution to the interpretation of experimental data.

COTTON

The various problems experienced with cotton production in the Transvaal Region were arranged in order of importance by the cotton action committee and the research programme aimed at solving these problems was accepted. Some of the first projects tackled concerned the chemical defoliation of cotton.

The national cotton cultivar trial was carried out at nine sites in the Transvaal Region. Some of the Alma types are doing very well at the Loskop Research Station and in the Lowveld. Yields of up to 6 000 kg per ha were obtained.

Certain Albar types are also doing well at most of the sites.

Breeding and selection

Because the 1973/74 breeding programme at Uppington was completely destroyed by the floods, a considerable amount of breeding material had to be multiplied during the past season in order to obtain sufficient seed for purposes of evaluation. A number of new selections were evidently very promising, particularly selections from breeding sources where 68/4/21 and Acala SJ-1 were among the parents.

Acala SJ-1 still appears to be the only promising breeding parent whose progeny show a fair amount of tolerance to both *Verticillium* wilt and red-leaf disease. Since *Verticillium* has been fairly severe during the past season, it has been possible to estimate the tolerance of some selections.

The promising new selection SJ-141 performed best in the co-operative trials along the Lower Orange River. The seed cotton yield from SJ-141 in these trials was significantly higher on the basis of statistics than that from the other entries, except selection 68/4/21. Selection SJ-141 produced 562 kg and 265 kg more seed cotton per ha than CA and Acala SJ-1 respectively.

SJ-141 is a selection of the Acala SJ-1 type which shows tolerance to both red-leaf disease and *Verticillium* wilt. In addition, this selection has a fibre length equivalent to that of CA, but longer than that of 68/4/21 and Acala SJ-1.

Fibre of the selection SJ-141 will be subjected to large-scale spinning tests during the coming season. If the results are satisfactory the selection will be released for the 1976/77 season to replace Acala SJ-1 along the Lower Orange River.

The latest yield trials at Vaalharts produced the following findings:

1. Acala 1517-70 performed better than CA and Acala 1517 BR-1, replacement of Acala 1517 BR-1 by Acala 1517-70 is therefore justified.

2. Unexpectedly, Acala SJ-1 performed considerably better than Acala 1517-70, CA and Acala 151 BR-1.

3. The highest seed cotton yields were obtained with the selections 70/92 and 70/217, which were selected for resistance to *Xanthomonas*. However, the fibre lengths of both selections are too short.

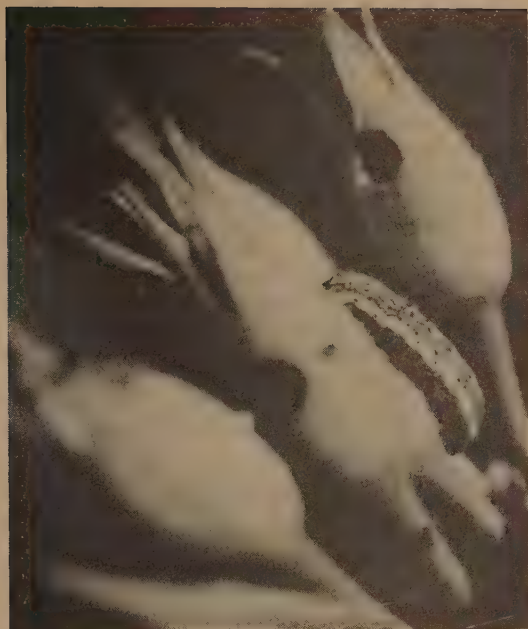
4. The incidence of angular leaf spot *Xanthomonas malvacearum* was again negligible.

5. The selections 71/8/14-3, 68/1/5C-2-4, 72/6/1-1 and 70/1/9-2-1 appear to have the most potential.

Fertilising

It was clear from a trial in which various levels of nitrogen fertilising were applied to cotton that the ideal nitrogen level is 90 to 110 kg per ha on the sandy soil of the Hutton form.

The application of too much nitrogen retards maturation and produces a lower quality fibre.



The American bollworm not only eats tobacco seed but also does great damage to the leaves

Irrigation

An irrigation trial with cotton showed that the ideal level of irrigation is the following:

Irrigation before planting time, followed by no irrigation until 6 weeks after planting, followed by irrigation every time 125 mm of moisture has evaporated from a Class A evaporation pan. This means that only 45 per cent of the available moisture in the soil is withdrawn between irrigations.

Pests

Five new preparations against the American bollworm *Heliothis armigera* were tested at Rust der Winter; one of these preparations was particularly unsatisfactory because of a build-up of red spider mite. The standard preparation, endosulphan, still appears to be the best. Average egg parasitism was higher in both sprayed and unsprayed plots than it was last season.

An imported egg parasite was released on a small scale and recovered.

Although insecticides at Vaalharts were tested against two bollworm species, the insect numbers were so low that no clear-cut conclusions could be drawn. The other trials were also hampered by low insect numbers and will have to be repeated.

Nematodes

Crop results show that a rotational cropping system that includes cotton and oats produces a higher cotton yield than is obtained with fumigation with ethylene dibromide or the application of Vydate. The latter two treatments did not differ significantly from the control.

These data are contrary to the results obtained with ethylene dibromide fumigation during the two preceding seasons. A new cotton variety, Del cerro, was planted and this may have affected the results.

Because oats was being included in a rotational cropping system with cotton, ten oat varieties were tested for their resistance to root-knot nematode *Meloidogyne incognita*. Lectoria, Saia, Van der Byl, Winter Dunn and Anita showed a very light infestation, and Langgewens, Valshawer, Heros, Sunrise and Sandton were not infested at all.

Similarly two wheat varieties - T4 and Inia - were tested for their susceptibility to root-knot nematode. They were both very lightly infested and there was no visible difference in the appearance of the plants.

It was also found that the cotton varieties Deltapine, Clarcot CS₂, Acala 15/17 Br 1 and 5 and Acala SV₁ are susceptible to infestation by the root-knot nematode.

It was found in the course of biological studies that adult females of the species *Meloidogyne incognita* are found in cotton roots as little as 3 weeks after infestation by larvae. After 6 weeks the cotton plants were heavily infested. Apart from the effect on the appearance of the cotton plants and the root systems, the pest also affected fruit formation, since infested plants bore considerably fewer bolls than the control plants.

GROUNDNUTS

A new groundnut cultivar, Sellie, which was bred by the Department, was released. Under irrigation at Vaalharts Sellie produced 20 per cent higher yields than Natal Common, which is the standard cultivar for commercial production. Seed of the new cultivar is being multiplied at present.

An investigation in which 170 groundnut breeding strains were tested showed that most local breeding strains are better adapted in South Africa than the imported cultivars.

The cross-breeding programme with crosses of F1 to F5 has produced material that is promising with regard to maturity, yield and tolerance for leaf spot diseases. Because of the serious increase in leaf spot diseases in most cultivation areas, breeding for tolerance for leaf diseases is receiving more and more attention in the breeding programme.

In a trial at the Loskop Research Station yields were raised considerably by planting rows close together. With a row width of 88 cm, 2 260 kg of kernels per ha was harvested. By reducing the row width to 12 cm it was possible to raise the kernel yield to 8 830 kg.

The practice of earthing up groundnuts is still

usual throughout the groundnut production areas, although it has long been discouraged. A project has been undertaken in the Highveld Region to demonstrate the disadvantages of this practice by exploring and illustrating the effect of the morphological and physiological disturbance in the plant.

Preliminary results indicate that the results of earthing up vary, depending on the intensity with which the practice is applied and the stage at which the groundnuts are earthed up, but that the practice may reduce production drastically. The cool, moist summer in Natal was not conducive to *Cercospora* leafspot development, but there was a high incidence of leaf blotch *Phoma arachidicola* and grey mould *Botrytis cinerea* on stems. It was possible to obtain good control of either of the diseases by using certain fungicides, but no single chemical used by growers was effective against both diseases.

Varying levels of irrigation with groundnuts as the trial crop corroborated the results of previous years, but this year the main conclusion drawn from the trial was that the period between planting and the first irrigation is very important.

Trials conducted during the past four years showed that groundnuts grown under extensive production conditions in the Republic are generally well nodulated, even if the seed was not treated with a legume inoculant. The nitrogen-fixing capacity of the rhizobia that form the nodules is fairly high, but on the average it is considerably poorer than that of the rhizobia used in inoculants.

Although inoculation appears to be unnecessary under conditions of low fertilising where factors other than nitrogen can limit growth, seed should nevertheless be inoculated where groundnuts are grown under conditions of intensive fertilising and irrigation because under such conditions the natural rhizobia may not supply the actively growing plants with sufficient nitrogen.

SUNFLOWER SEED

An estimated 4 000 ha was planted to hybrid sunflowers in South Africa this year. These hybrids did very well, especially with regard to oil content and resistance to disease. Producers are showing particular interest in sunflower hybrids.

The considerable area producers planted to sunflowers during a season in which the rainfall was high (traditionally mainly a maize season) is an indication that sunflowers are being accepted as a main crop.

In a yield trial made up last season in the Highveld Region with 113 hybrids, several entries performed better than all the available cultivars except Kort Rus. A further 108 hybrids were collected for yield trials during the coming season.

A number of new breeding strains and sources

were obtained from overseas collaborators and a large quantity of seed was produced in collaboration with a co-operative for the INRA of France.

Twenty-six sunflower cultivars were tested under irrigation at the Sand-Vet Research Station. The cultivars grew very well and a yield of 6 097 kg per ha was obtained from the strain S 73019, the second best yield being 5 313 kg per ha from H 200.

A cultivar trial at Ermelo produced a very good seed yield of 3,7 tons per ha, and the exceptional yield of 6,5 tons per ha was obtained under irrigation at Groblersdal.

At the Dundee Research Station severe boron deficiency symptoms in sunflowers have been recorded on the Hutton and Avalon soil forms. On an acid soil sunflower seed yields were increased sevenfold by liming to pH 4,5.

Herbicide trials at Pretoria and Ermelo indicate that a few herbicides are very promising and that both broad-leaved weeds and grasses can be controlled.

Plant population studies showed that increasing the stand from 23 350 to 70 050 plants per ha increased the oil content of the seed significantly, but did not increase the seed yield.

DRY BEANS

Yield trials were conducted with 177 selected strains and 5 standard cultivars, and 11 strains are being multiplied by means of seed in the Lowveld for registration as cultivars. Some of the best strains produced a yield of up to 50 per cent more than that of the existing cultivars (small white types). The tests also showed that some of the local strains have excellent cooking qualities.

Yields of up to 5 tons per ha were obtained with large white kidney beans at the Nootgedacht Research Station at Ermelo.

In the course of intensive trials under controlled environmental conditions the effect of various day/night temperature combinations (air temperature) and growth medium temperatures on the flower formation, pod setting and seed yields of four Michigan dry bean cultivars was investigated.

Day temperature appears to play a far more important part than night temperature in the reproduction of Michigan dry beans. The high day temperature (32°C) retarded flower formation and resulted in more flower abscission and lower seed yields. Flower formation tended to start earlier at a higher night temperature (18°C) than at lower night temperatures (12°C and 15°C).

Selected dry bean varieties were planted at the Kokstad Research Station to determine adaptability and yield potential.

The air-dried grain yield varied from 5 690 kg per ha to 345 kg per ha.

The trial has indicated the feasibility of dry beans as a cash crop in the area, but more data are needed before definite recommendations can be made.

Four dry bean cultivars were tested at Glen, with varying planting times and espacements. It

was shown that November plantings did better than beans planted a month earlier or a month later. White Dutch Princess was the best cultivar, with a yield of 2 769 kg per ha at an espacement of 60,0 x 7,5 cm.

Of the 17 cultivars tested at Sand-Vet, large white kidney beans produced the best yield - 4 000 kg per ha. This cultivar is not very acceptable for the market, however.

During the past season favourable conditions for the development of bacterial diseases resulted in enormous damage to the dry bean crop. These diseases, which are seed-borne, caused a high level of infection last season, but climatic conditions were not favourable for the further development of the diseases.

Clearly the only solution to this problem is the use of disease-free bean seed. The disinfection of the seed of a number of the most promising dry bean cultivars has already begun; this seed is to be made free of bacteria so that seed multiplication can be started with clean basic seed.

SOYA-BEANS

A season in which the rainfall was abnormally high and conditions relatively cool again demonstrated the need for soya-bean cultivars with a short growing season.

Cultivar trials at Ermelo indicated that cultivars with a short growing season produced the highest grain yield (4,5 tons per ha) in this cool, high-lying area. In the hot conditions at Groblersdal the cultivars with a long growing season produced the highest yield (6 tons per ha).

In experiments at the Cedara, Kokstad and Dundee Research Stations yields of over 3 000 kg per ha were attained with some new cultivars during the past two seasons.

In 1973/74 the highest yields at Cedara were attained with Pioneer 701 (3 674 kg per ha), SSS 2 (3 421 kg per ha), Welkom (3 396 kg per ha), Solar (3 296 kg per ha), Geduld (3 261 kg per ha), SSS 3 (3 097 kg per ha) and Kent (2 912 kg per ha).

At Kokstad top yielders were Kent (3 993 kg per ha), Masterpiece (3 043 kg per ha), and Rhosa (2 894 kg per ha).

The highest yields at Dundee were obtained from Rhosa (3 163 kg per ha), Kent (3 153 kg per ha), Geduld (2 489 kg per ha) and Masterpiece (2 468 kg per ha).

In the 1974/75 season at Cedara the cultivars with a short growing season, viz Usutu (3 197 kg per ha), Shelby (2 709 kg per ha) and Kent (2 657 kg per ha), gave the highest yields. Owing to the dry conditions in March the late maturing cultivars were less successful during the past season.

At Dundee, however, the later varieties Welkom, Geduld and Pioneer 701 gave the highest yields. Grain yields of over 4 000 kg per ha were recorded at this site.

The effect of the planting time on the yield of various cultivars is being investigated at Cedara. Results indicate that most cultivars can be planted with success up to the end of November.

Trials at the Sand-Vet Research Station with 15 soya-bean cultivars under irrigation showed that Eland and Welkom Potch, with a yield of 4 814 kg per ha, were the best cultivars. Relatively few problems were experienced with shattering during harvesting.

Formation of nodules - About 100 soya-bean plantings were examined on 43 farms in the most important soya-bean areas this year. Inoculated seed showed good nodule formation throughout, but uninoculated plants had no nodules or only a few ineffective ones. It was also found that even in fields where soya-beans had been grown previously and where the plants had been inoculated at some stage but not the previous season, the nodules were poorer than in inoculated fields. Soya-bean seed should therefore be inoculated, even if inoculated seed was planted on that soil a few seasons previously.

CHICORY

The possibility of producing chicory seed locally was investigated further. The results of seed production trials carried out in colder irrigation areas showed that up to 400 kg of seed per ha could be obtained although all the plants did not produce seed. It is predicted that this problem could be eliminated by means of selection.

The seed was of a fairly good quality and although the viability was not all it should have been in a few cases, germination percentages of up to 90 per cent were obtained.

The possibility of developing a local cultivar is enjoying attention. The first selections from an open-pollinated population have been made for transplanting during the coming year.

Fertilising - Trials carried out in the Alexandria district over a period of six years have shown that increased fertilising is required, especially where the rows are fairly close together.

Preliminary observations show that rotational cropping has a beneficial effect on the yield from chicory planted afterwards.

Planting - The use of pelleted chicory seed, planted with precision planters, has increased considerably, especially since improved seed pellets became available.

Results of trials in the Alexandria district show that the total chicory root yield can be increased significantly by spacing the rows 30 cm or 45 cm apart instead of 70 to 90 cm, as is the current practice.

Diseases and pests - It was established that stubby root is caused by *Fusarium oxysporum*. This problem, which appears to be increasing, requires further investigation. There are no control measures at present. However, the inclusion of a ley crop appears to reduce the incidence of the disease.

The tobacco and tomato spotted wilt viruses have been isolated in chicory. Black rot appears to be a serious problem, especially under fairly damp conditions. There are indications that this disease is caused by a *Phoma* fungus.

Weeds - Trials aimed at finding a suitable selective weedkiller for use on chicory have shown encouraging results. Apparently the mixture used to control the winter weed population is not suitable for use with summer plantings. A post-planting application seems to be the most successful in both cases.

Harvesting - Chicory is still harvested by hand. An investigation aimed at exploring the possibility of lifting chicory and then handling it in bulk has been started.

ARTIFICIAL PASTURES AND FORAGE CROPS

LUCERNE

The national lucerne breeding programme at the Grootfontein College of Agriculture was intensified, especially with regard to breeding for resistance to the root disease complex. The results showed that the locally bred lucerne cultivar Karoo 70 has a longer life than South African Standard lucerne and consequently produces a higher yield.

Good progress was also made in the breeding programme with the development of a prostrate type of lucerne which is particularly suitable for grazing and for dryland planting in the high rainfall areas.

There is a great deal of interest at present in the artificial drying of lucerne to produce lucerne hay of a high quality.

LUCERNE GRASS MIXTURES

The planting of lucerne/grass mixtures is arousing a great deal of interest in the Karoo Region at present. This interest has been stimulated by the high cost of harvesting lucerne hay and the good stock prices.

It has been found that lucerne produces the best results in mixtures with perennial grasses such as tall fescue (*Festuca arundinacea*) and canary grass *Phalaris tuberosa*.

LUCERNE/CLOVER PASTURES

The lucerne earth flea *Sminthurus viridis* and the black sand mite *Halotydeus destructor* are generally regarded as the chief pests of artificial lucerne/clover pastures in the Winter Rainfall Region. For several reasons biological control appears to be the only possible solution.

During the past decade three types of predatory mite, *Bdellodes lapidaria*, *Neomolgus capillatus* and *Anystis* sp. were imported from overseas to see whether they could control the pests. *Anystis* sp. appears to be the most successful so far. This species was released at Stellenbosch in 1969 and sufficient numbers were available in 1974 for distribution to two sites at Caledon, where they were successfully established. Since it is in the nature of this predatory insect to spread slowly, the eventual success of the project depends on artificial distribution over the infested areas.

NITROGEN FIXING IN GRASS

The Plant Protection Research Institute started a survey of grass species planted for grazing purposes to determine whether any of them are able to supply part of their own nitrogen requirements through the stimulation of nitrogen fixing bacteria in the rhizosphere. The rising prices of nitrogen fertilisers justify this type of investigation.

Although it is clear that many factors play a part here, promising results have already been obtained with *Paspalum* and weeping love grass. The investigation is being continued.

CENCHRUS CILIARIS

A comprehensive research programme on the evaluation of buffalo grass *Cenchrus ciliaris* was launched at the Mara, Towoomba and Rooodeplaar Research Stations in 1973. The following are the most important preliminary results:

1. Where about 20 per cent of the veld is replaced with buffalo grass pastures the carrying capacity of the unit is virtually doubled. Under irrigation such grass can carry about 50 sheep per ha in summer.
2. Where buffalo grass pastures grown under dryland conditions carry one young ox on $\frac{1}{4}$ ha, an average daily mass increase of 700 g per ox can be expected. Cows with calves gain about 330 g/day and calves gain about 1 kg.
3. The optimum level of nitrogen fertilising will depend chiefly on the rainfall. In general it appears that the optimum level is about 90 kg of nitrogen per ha. The biggest response to nitrogen fertilising can be expected in December.
4. The growth pattern of buffalo grass was also investigated. It was found that under dryland conditions the grass attains maximum growth at 12 to 15 weeks.
5. Under favourable establishment conditions a seeding density of 1,5 kg of seed per ha will produce the same result as, for instance, 6 kg of seed per ha. Buffalo grass established in 75 cm rows produced a higher yield than 150 cm rows or broadcast stands.
6. The feeding of large quantities of hay to cattle on buffalo grass pastures in winter has a beneficial effect on grass production during the following summer. It was found, for instance, that when 20 tons of hay per ha is fed the production from the pasture is equivalent to that from pastures fertilised with 180 kg of nitrogen per ha.
7. Although buffalo grass is well adapted in the Bushveld areas, the higher fertiliser prices may restrict further plantings. At the present meat and fertiliser prices it may still be economic to raise young oxen on this type of pasture, but the production of calves does not appear to be profitable. The emphasis in this research programme will have to be shifted to the evaluation of any legumes that could have potential for cultivation with grass in the Bushveld areas.

Several buffalo grass selections were established under irrigation on a Rensburg soil in the Highveld Region. During the first winter four



A fine stand of dryland lucerne in the Hertzogville district

selections, namely Beaufort West, Biloela, Chipinga and Nunbank, were completely wiped out by frost. Tarwinnebar selection did not establish well but was able to survive the winter conditions. The Molopo and 42/8 selections established well from the start, survived the winter cold and are now producing good plant yields.

WOOL GRASS

Wool grass *Antheophora pubescens* could be an important crop on the light sandy soils commonly found in the western parts of the Molopo area. It is indigenous in these parts and in other localities where the clay content of the soil is very low. The ecotypes that occur naturally there produce very little leafy material however, so that it was necessary to select ecotypes from a number of selections (28). Four of these selections produced fairly high dry matter and seed yields.

GRASS LEGUME PASTURES

Two grasses, *Hordeum murinum* (barley grass) and *Bromus diandrus*, were found to be troublesome in lucerne-medic-ryegrass pastures at Riviersonderend. Wool yields were negatively correlated with the occurrence of the former, and the latter resulted in the downgrading of carcasses owing to penetration of seeds into the flesh.

Excellent control (96 per cent) of the grasses, including ryegrass, was achieved by spraying pronamide in June. In September sprayed camps were 90 per cent richer in legumes and yielded 22 per cent more dry matter than unsprayed camps.

A study of the growth patterns of pastures (consisting chiefly of *Medicago sativa*, *M. truncatula*, *Trifolium subterraneum*, *Lolium rigidum*, *Hordeum murinum* and *Erodium moschatum*) in the Rûens and Swartland revealed that growth rates in spring are generally twice as high as those in autumn. During the midwinter period the growth rate of lucerne, chiefly a summer grower, was depressed to a greater extent than that of the medics.

Medics and grasses were the quickest to respond to favourable conditions in spring, and *Erodium moschatum* came away most rapidly in autumn.

In the Swartland total pasture growth was strongly dependent on the proportion of medic in the sward.

In the Rûens the value of medics in stabilising the source of feed for summer use was clearly demonstrated in the 1974/75 summer, which proved to be very dry. Even though the proportion of medic in the pastures was never recorded as more than two-thirds, the yield of pods in one case was found to be 2,3 metric tons per hectare. Lucerne on the other hand proved of value only near the mountains where more summer rain occurred. Even so the highest summer yield of lucerne recorded was less than one metric ton per hectare.



The new Italian rye grass cultivar, Midmar, makes excellent palatable pasture

QUICK GRASS

In its second year at two co-operative sites at Wartburg and Umlaas Road (irrigated) *Cynodon dactylon* (cv. Coastcross 2) yielded 17,8 and 24,8 metric tons respectively.

At De Hoek Research Station (Estcourt area) steers grazing *Cynodon nlemfuense* (star grass) produced an average of 780 kg live mass per ha at an average daily gain per animal of 0,6 kg per day over the last two seasons. At a heavier stocking rate the figures were 865 kg per ha and 0,5 kg per day.

On a grazing trial at Tabamhlope Research Station beef steers gained 98 kg per ha on veld, 647 kg per ha on Nile grass *Acroceras macrum* and clover *Trifolium repens* and 850 kg per ha on kikuyu *Pennisetum clandestinum*, with nitrogen fertiliser during the 1973/74 season.

ITALIAN RYEGRASS

The new diploid Italian ryegrass cultivar, Midmar, has been included in the varietal list.

The outstanding features of the new cultivar are its uniformity, high yielding ability, low winter dormancy and excellent resistance to leaf rust.

More than 1000 kg of basic seed was produced at Cedara and Potchefstroom in 1974, most of which was subsequently allocated to registered seed growers for certified seed production purposes. Certified seed is being produced at several localities in the Natal Region and will be commercially available early in 1976.

In a series of trials conducted at various localities in South Africa in 1974, Midmar was the highest yielding cultivar at Cedara, Kokstad, Dundee, Tabamhlope (near Estcourt) and Stutterheim.

NILE GRASS

Yields ranging from 0,80 to 10,22 metric tons of dry matter per ha were obtained during the second year of evaluation of 25 Nile grass strains at Cedara.

Several single cross hybrids have been evolved and seed of these has been utilised in the establishment of a yield trial. One of these hybrids (AM-44 x AM-66) which was derived from two high yielding, disease resistant and compatible parent plants, has shown particular promise. Consideration is being given to its release as a new cultivar.

COCKSFOOT

Application has been made for inclusion in the varietal list of the new Cedara-bred cultivar Karkloof.

Karkloof has an excellent seedling vigour and establishes more rapidly than other locally available cultivars. Consequently its autumn yield in the year of establishment, following late summer planting, is also superior. It also exhibits less winter dormancy than most recognised cultivars.

In an experiment at Cedara its dry matter yield was 14,6 tons per hectare during the first 12 months. This was 25 per cent superior to a widely grown cultivar of European origin.

Karkloof is uniform, a prolific seed producer and only slightly susceptible to strains of leaf rust occurring in South Africa, whereas the imported cultivars exhibit varying degrees of susceptibility.

DIGITARIA

Several *Digitaria* species are being evaluated under grazing, at various cutting stages, at Cedara at present.

The prostrate *D. milaniana* introductions seem very promising with regard to both yield and grazing tolerance.

FORAGE SORGHUM HYBRIDS

Forage sorghums planted in December produced twice as high a yield as those planted in February. The best yields were obtained from Kow Kandy and Hidan, which produced 8 360 and 8 138 kg of dry matter per ha respectively.

Promising results were obtained with the cultivar Tridan II, which was planted in 40 cm rows, using 2 to 6 kg of seed per ha. Yields of as much as 7 600 kg of dry matter per ha were produced in the trial. It was found that cutting at the young stage cannot be compared with cutting at the flowering stage from the point of view of yield.

In a trial on a deep Hutton soil three forage sorghum hybrids were fertilised with various levels of nitrogen and phosphate and cut at three different stages. The best yield of 11 tons of dry matter per ha (3 cuttings) was obtained from Haygrazer, fertilised with 20 kg of nitrogen and 26 kg of phosphate per ha and cut at the soft dough stage.

MAIZE SILAGE

Interest in maize silage production is steadily increasing in the Natal Region, owing mainly to the more intensive feeding of animals and the availability of smaller and less costly forage harvesters.

To meet the needs of the farmers in the different parts of Natal four experiments, one each at Cedara, Dundee, Kokstad and Tabamhlope, have been conducted over the past three seasons.

At all four sites the late maturing hybrids PNR 353 and/or SR 52 have given the highest yields. At Kokstad and Tabamhlope yields in excess of 20 tons of dry matter per hectare have been achieved with these hybrids, but only where harvesting was delayed to at least 8 weeks after silking. At Cedara and Dundee top dry matter yields were of the order of 16 tons per hectare.

These experiments have shown the importance of delaying harvesting to the glazed stage. Earlier cutting results in lower yields, a low dry matter content and a low proportion of grain in the silage.

SPINELESS CACTUS

Very good results were obtained with the production of fruit from spineless cactus selections. The best six green-leaved spineless cactus cultivars produced 55 metric tons of marketable fruit per ha at the age of four years. There is a great deal of interest in the production of fruit from spineless cactus. During the year under review 1 876 applications for the supply of planting material were received.

There has been sustained interest in the planting of blue-leaved spineless cactus for stock feed. Farmers with plantings of spineless cactus always plant more, but there are still many farmers who have not yet realised the value of this important drought-resistant forage crop.

SALTBUSH

Farmers are showing a great deal of interest in the planting of old man saltbush *Atriplex numularia*. Despite the fact that 980 kg of seed was sold to farmers, the demand for seed could not be met. In the Petrusville district an active study group stimulated the planting of saltbush considerably. One of the members planted 200 ha and designed and built an efficient mechanical planter.

Very good results were also obtained with the reclamation of bare patches with the aid of old man saltbush and Australian creeping saltbush *Atriplex semi-baccata*. The locally developed basin plough is very useful here.

The evaluation of new introductions was continued. It was found that *Atriplex canescens* can provide 3 000 sheep grazing days per ha in summer, and *Atriplex lentiformis* and *Atriplex breweri* 2 400 sheep grazing days per ha in winter. Old man saltbush provided 2 600 sheep grazing days in the same grazing trials.

The selection of more palatable plants among

old man saltbush populations was continued. Populations built up from the more palatable selections were grazed and it was found that the initial palatability of old man saltbush can be raised by 60 per cent. Large plantings of these more palatable plants are being undertaken at present for further evaluation and seed production.

As a result of the higher fuel costs and the high cost of implements there is a great deal of interest in the planting of old man saltbush on fields in the Karoo Region. In practice these plantings provide seed at a lower cost than annual small grain plantings.

5. Horticulture

DECIDUOUS FRUIT

WINTER RAINFALL AREA

APPLES

Breeding and evaluation

Two apple selections are receiving special attention. A very early red apple selection, E12/14, which was bred by the Fruit and Fruit Technology Research Institute, is so promising that trees are being multiplied on a large scale for co-operative evaluation. The quality of this selection is outstanding, but it colours very unevenly. As regards colour, it responds very well to spraying with Ethepon (Ethrel) together with 2,4,5-TP three weeks before the normal picking time. Harvesting is also advanced by 10 to 14 days, which augurs well for the cultivar, particularly on the local market.

A late red apple selection, which ripens at almost the same time as Granny Smith, is also undergoing further evaluation.

Several imported Red Delicious types were very promising as regards colour development. The best of these were Topred, Wellspur Delicious and Hawkes Bay. At least one Golden Delicious type showed much less russeting than ordinary Golden Delicious during the past year.

Planting systems

The lighting of densely planted trees was improved by severe winter pruning and the application of Alar, followed by summer pruning, which clearly improved the crop and the fruit size on the lower and inner parts of the tree. The densely planted trees (4 metres by 2 metres, palmette) on the Elgin Experimental Farm yielded roughly 100 tons per ha, and the crop from widely spaced trees is still increasing. Other trials, in which apple rootstocks are being compared using various training systems and espacements, are progressing well. It is already clear that the trees on dwarf rootstocks start bearing earlier.

Pest and disease control

The effect of codling moth control programmes based on sex trap monitor using systems on other pests was investigated in 800 hectares of apple and pear orchards. It was found

that pest control can profitably be implemented with a considerable saving on costs.

However, there were considerable fluctuations in the populations of weevils on apples, leaf rollers on pears and mealybugs on apples and pears where reduced codling moth control programmes were not applied with the necessary care.

Integrated control of mites

Various pre-flowering sprays were used on apple trees. Winter oil and a green-tip oil showed no adverse effect on *A. rubicolus*, but suppressed the European red mite and *T. grabouwi*. Fungicides differed as regards their effect on *T. grabouwi*, *A. rubicolus* and the European red mite.

Mites were monitored in 18 commercial apple orchards and 11 pear orchards. The most common predatory mite was *T. grabouwi*, but this predator was not effective enough to make the application of chemical control measures unnecessary, although the number of miticide sprayings was reduced, particularly against *T. cinnabarinus*. *A. rubicolus* appeared late in the season and the numbers were too low to be of any use, but in one of the pear orchards it occurred in sufficient numbers to eliminate the need for any miticide sprayings.

Apple scab (Fusicladium)

Certain aspects of the infection of apple leaves and fruit by apple scab were intensively investigated with a view to warning producers when infection occurs.

It was found that the ascospore concentration from apple scab was very high up to 20 m from the source (last season's infected leaves). Beyond this the concentration decreased rapidly. A few spores were blown as far as 60 m by the wind.

The age of apple leaves had an effect on their susceptibility to infection by ascospores. Leaves which had opened four days previously had the most scab lesions, and leaves which had opened nine or more days previously could not be infected.

During infection trials with Granny Smith apples, high percentages of storage fusicladium occurred where the apples remained wet for periods of 78 hours and longer. The development of storage fusicladium cannot be controlled by dipping the fruit in fungicide suspensions after picking.

From 24 September to 31 December 1974 twelve natural infection periods were measured on the Elgin Experimental Farm. Indications were found that scab on certain farms in the Langkloof has developed immunity to BMC preparations. On



Nine-year-old apple trees, planted by 6 m by 3 m apart and grafted onto seedling rootstocks

these farms BMC preparations have been used exclusively for scab control for several seasons.

Spraying techniques

By using ultra-low volume spraying techniques with an oil-water emulsion as liquid vehicle it was possible to control apple scab, apple mildew and red spider mite just as effectively with a half dose of the active spray as with high volume spraying using the full dose. Precipitation studies showed that twice as much active spray is deposited by means of ultra-low volume spraying as by means of low volume and high volume spraying.

It will therefore not be possible to consider the general use of this application technique until it is established what adjustments to the safety period before harvesting are required to ensure that the prescribed tolerance values are not exceeded.

Bitter pit

In a semi-commercial trial with Golden Delicious apples it was found that where the normal three sprayings with 0.65 per cent calcium nitrate solution were applied at fortnightly intervals from the middle of December to the middle of January, 2.3 per cent of the apples had bitter pit, as against 1.4 per cent where six sprayings were applied at weekly intervals during the same period.

Where six sprayings were applied at fortnightly intervals from the middle of December to the end of February the bitter pit percentage was 5.3. In a trial where up to 20 tons of agricultural lime per ha were applied, no effect on the incidence of bitter pit was observed after one year.

Apple mosaic

The serological identification of apple mosaic has so far only been possible from flowers, i.e. from bearing trees. Investigations have now revealed that the woodland strawberry can be used as an intermediary host plant in the transmission of

apple mosaic from nursery trees to herbaceous plants, which makes reliable serological tracing in nursery material possible.

Disinfecting of cold stores

The role played by air borne fungus spores in cold stores in the development of post-harvest diseases is as yet unknown, but is nevertheless a factor to be reckoned with. Recent trials with fumigants have shown that a fumigation tablet containing thiabendazole as the active ingredient effectively lowers the number of air borne spores in experimental and commercial cold stores, and can be recommended. Infected fruit containers can be effectively disinfected with any fungicide registered for this purpose.

PEARS

Breeding and selection

Of the 13 pear crosses and cultivars at present being evaluated, the crosses 5/39 and 18/5, together with an early Packham's Triumph cultivar from a private breeder, were the most important.

Packing

The investigation of the new non-ventilated cardboard pack was continued because problems are still being experienced with certain cultivars. The effect of 100 needle holes in the polyethylene bag used inside the carton pack was investigated. This modification led to a reduction in gas injury.

Results this season again emphasised the way keeping quality per cultivar varies from season to season. Bon Chrétien pears were very susceptible to gas injury during the past season. Beurré Bosc, Doyenne du Comice and Packham's Triumph showed no signs of gas injury during the three successive seasons, even where the pears were packed at 21°C and then cooled slowly to -0.5°C over a period of six weeks. These results indicate



The promising early red apple selection E/12/14 ripens at the same time as Ohenimuri. It was bred by the Fruit and Fruit Technology Research Institute

that the precooling requirements for these cultivars can be relaxed considerably.

An investigation of the *virus status* of apple and pear nursery material now available in the industry showed that latent virus diseases are common in the apple cultivars Starking, Golden Delicious and Granny Smith and in the pear cultivars Beurré Hardy, Packham's Triumph and Bon Chrétien. In apples the infection varied from 91 to 57 per cent, and in pears from 76 to 53 per cent.

Overseas discoveries concerning the effect of these viruses on production and quality justify the assumption that latent virus diseases reduce the local production of apples and pears by 30 per cent or more.

The latent viruses *Platycarpa* scaly bark and *Platycarpa* dwarf were detected for the first time in local apple orchards.

APRICOTS

Breeding and selection

In February 1975 grafting material from the promising selection 35/9 from the FFTRI's breeding programme was made available to the industry. A second very promising apricot selection with the code number 36/39, which has particularly good properties as regards disease tolerance and canning quality, will be finally evaluated on producers' farms shortly.

Rootstocks

One of the local selections where Marianna crosses were used as rootstocks clearly had a dwarfing effect on apricot trees.

An important breakthrough for the industry was made when the moisture sensitivity of drupe rootstocks was determined. It was found that the various drupe rootstocks can be classified as follows as regards their sensitivity to waterlogging,

from the most sensitive to the most resistant: apricot seedlings, Okinawa, Nemaguard, Kakamas seedlings, Du Plessis seedlings and Marianna.

PEACHES

Breeding and selection

A white-fleshed dessert peach selection (code number 10/35) which has a good keeping quality and ripens after Peregrine has already been multiplied for final evaluation. The other cultivars and selections being evaluated include a number of promising cultivars and selections such as the imported Red Globe, Red Top, Pannamint and Flamekist. The latter two are nectarine types. Pannamint showed very good storage qualities.

Summer pruning

The summer pruning of peaches is already undertaken on a large scale by farmers. This makes denser planting possible, so that a larger crop can be harvested in the first few years. The elimination of winter pruning will considerably reduce the risk of silver leaf infection.

Sterilising fruit flies by means of irradiation

During the past year a breakthrough was made with the mass breeding of the Natal fruit fly *Pterandrus rosa*. It is now possible to keep up to 20 000 flies in a single cage, with a resultant reduction in maintenance requirements. The eggs are collected in artificial egg laying devices and can then be placed directly on the larval medium.

It was established that ten-day old pupae (shortly before emergence) are at the stage of *P. rosa* that is most resistant to irradiation and that both sexes of this stage are sterilised by about 13 krad.



Gas damage to Beurre Hardy pears that were kept in cartons for four months at 4,5 degrees C

PLUMS

Breeding and selection

Of the 52 plum crosses and cultivars which were tested, the two newly released cultivars Harry Pickstone and Songold displayed the best storage properties.

Immersion from crates

It was shown that plums in the packing shed can be emptied from the crates into the immersion tank if a 5 per cent to 9 per cent solution of sodium sulphate is used in the tank so that the plums float in the solution. This method is impractical and expensive, however.

It has been suggested that a lift conveyer belt be used to take the plums from below the tank to the sorting conveyer belt.

Plum packing

Circumstances sometimes make it impossible for plums to be packed directly after harvesting, but only after about five days in cold storage. During the past season it was established that the percentage of mechanical injury to plums is higher when the plums are first cooled and then packed than vice versa. The increase in damage was relatively small with the cultivars Santa Rosa and Gaviota, but with Golden King the damage level rose from 9 per cent for uncooled fruit to 16 per

cent for fruit stored for five days at a temperature of $-0,5^{\circ}\text{C}$ before packing.

Packers of Golden King are therefore advised to pack the plums directly after harvesting and to precool the packed containers as soon as possible.

PRUNES

Influence of ripeness on the processed product

The influence of the degree of ripeness on the quality of the dried product was investigated. Half-ripe and fully ripe prunes were sun dried and dehydrated and then graded according to commercial standards by the South African Dried Fruit Co-operative.

Where sun drying was used the fully ripe fruit yielded a return of R302,90 per ton, as against R289,10 for the half-ripe fruit. The corresponding values where dehydration was used were R418,10 and R342,70, respectively. It should also be noted that the drying ratios were 2,76:1 for fully ripe fruit and 2,91:1 for half-ripe fruit.

The value of the fully ripe fruit was therefore 11 per cent more than that of the half-ripe fruit with sun drying and 13 per cent more with dehydration.

It was also noticeable how much higher the per ton value of the dehydrated prunes was than that of the sun-dried prunes.

CHERRIES

South African canners annually import about 400 tons of artificially coloured cherries to the value of more than R1 million. Trials were therefore conducted by the FFTRI with preserved cherries from Ficksburg with a view to developing an effective colouring process.

After various aspects of the process had been investigated, a suitable practical method of producing canned stoned and coloured cherries without diffusion was developed. Such cherries are an essential ingredient of a canned fruit cocktail. Equally satisfactory results were obtained with both cultivars which were used this year, viz Emperor Frances and Napoleon Biggareau.

STRAWBERRIES

Breeding and selection

A total of 24 selections were tested, two of which, 71/7 and 71/8, did very well. The crop from both these selections was better than that from Parfaite and the fruit lost less juice during thawing after freezing. The size, colour and appearance of the fruit was also very good.

Selection Ti 86/4, which, looked very promising the previous year, was disappointing during the past season as regards the size of the crop and the fruit.

Irradiation

Gamma irradiation of strawberries succeeded in controlling *Botrytis*, but adversely affected the texture of the fruit. The acid content decreased significantly, and there are indications that the sugar content increased. Bleaching also occurred, particularly in fruit which was picked while still on the green side.

Packing and precooling

Despite claims by certain strawberry experts that Parfaite is too soft for export, it was proved that this cultivar can be supplied to overseas markets in single layer packing in a good condition and that it fetches very good prices.

The effect of polystyrene containers and corrugated cardboard containers on the quality of export strawberries was compared; it was found that the quality is retained much better in the polystyrene packing than in the corrugated cardboard packing. The strawberries in the polystyrene containers fetched an average of 20 c per kg more than those in the cardboard packing.

The necessity of a degree of precooling after the harvesting and packing of export strawberries was proved beyond all doubt. Trials with consignments of 100 kg showed that precooling up to 10°C was adequate. Good results were obtained with consignments which were precooled only at the airport, provided that the time from harvesting to the start of precooling was kept to less than 4 hours.

Large fluctuations in temperature during the

air journey had a detrimental effect on the quality of export strawberries. The polystyrene packing largely eliminated any major fluctuations in temperature.

The strawberry plant improvement scheme helped a great deal to improve the general standard of strawberry planting material. The sound co-operation from the industry is reflected in the good condition of plant samples, derived from parent blocks, which were investigated for virus diseases and nematode infestation by the Plant Protection Research Institute.

Foundation material from the cultivar Selektia was released to the strawberry plant multiplication organisation this season.

SUMMER RAINFALL AREA

PEACHES

Rootstock breeding and nematode resistance

It is a general phenomenon that nematode-resistant crops sometimes lose their resistance when the soil temperature is very high for fairly long periods. It was therefore considered important to establish whether the two Nemaguard clones, Nos 8 and 14, which are resistant to the two nematodes which commonly occur in peach orchards in South Africa, would lose their resistance when the rootstocks are used in very hot areas.

The resistance of the rootstocks to infestation by the two nematodes *Meloidogyne incognita* and *M. javanica* when the rootstocks are grown in soils whose temperature is maintained at 28°C was therefore determined. It was found that the two Nemaguard clones did not lose their resistance to these two nematode species at the high soil temperature. They can therefore be recommended as nematode-resistant peach rootstocks, even for the hot production areas.

Histological studies showed that both the resistant Nemaguard and the nematode-sensitive Transvaal yellow peach rootstock are penetrated by the *M. incognita* nematode. However, the difference in resistance is that the nematode develops fully and breeds in the roots of the sensitive Transvaal yellow peach, whereas in the Nemaguard rootstock dead tissue and later lignin fibre forms around the nematode. In this way the nematode in the Nemaguard root is isolated from a source of food and dies. No multiplication of the nematode therefore occurs in the Nemaguard rootstock and the characteristic lumps are not found on the roots and dead roots.

Diseases

A case of *Trichothecium* rot was found for the first time on peaches in the Transvaal. There were abnormally heavy rains and moist conditions during the past season and it is doubtful whether the disease would assume serious proportions under normal conditions.



Intensive planting of canning peach trees that are pruned in summer

CHERRIES

Progress at the cherry experimental farm

During the past planting season 14 077 cherry trees at the orchards of approved breeders were certified as "visually approved propagation material" under the cherry plant improvement scheme. These trees were supplied to the industry for planting.

During the winter of 1974 virus-tested propagation material from the cherry experimental farm at Ficksburg was issued under the scheme to four approved breeders as parent material. This material consisted of 16 340 cherry cultivar buds and 890 rooted rootstocks.

Propagation studies

Propagation studies with rootstocks indicate that the Mahaleb clone B40 still roots more easily with hardwood cuttings than the ordinary Mahaleb. The planting date of Mahaleb hardwood cuttings can greatly affect rooting, depending on the winter climate and the soil temperatures. During the past season rooting was clearly better when transplanting was done in July than when the cuttings were transplanted in May. Three transplanting periods, viz May, June and July, can be provisionally recommended.

The multiplication of the Mazzard F12/1 rootstock with softwood cuttings under mist blower irrigation was fairly successful. Up to 35 per cent rooted trees were obtained by this method. Initial indications are that Mazzard F12/1 propagates well

with hardwood cuttings when the bases of the shoots are kept under an earth bank by banking the cuttings up for one season. Sixty per cent rooting was obtained with these etiolated cuttings.

The new Mazzard hybrids (Fb 2/58/48 and Fb 2/58/38) can very easily be multiplied by means of hardwood cuttings. A multiplication figure of 77 per cent was obtained with Fb 2/58/48 when the base of the cutting was treated with 1 000 ppm of indolebutric acid. These hybrids have both already been established for further evaluation in a rootstock trial and can be of great importance to the cherry industry owing to the ease with which they can be multiplied.

STRAWBERRIES

The following quantities of foundation material were released to approved breeders under the strawberry plant improvement scheme: Earlibelle 770, Parfaite 1 240, Selekt 2 070, Tioga 760 and other 670.

Physarum sp., a fungus which usually occurs in wet weather on grass, was observed on strawberry leaves at Rooideplaas where grass clippings were used as a soil mulch.

TABLE GRAPES

WINTER RAINFALL REGION

Breeding and selection

Of the promising selections provisionally evaluated, one with the code number 17/19 will



Pests like codling moths are monitored in the orchard

soon be planted on a large scale on a producer's farm for final evaluation. This early white selection has good bunch characteristics and is not subject to berry cracking like Queen of the Vineyard.

A further 26 promising selections from the breeding programme are at present undergoing provisional evaluation. More cultivars and rootstocks from overseas which may be important here are being imported and the evaluation of new rootstocks such as the Paulsen crossings, Ruggeri and crossings bred locally is continuing.

The Alphonse Lavallée clone released recently after four years of statistical evaluation on the Bien Donné Experimental Farm did the best out of 31 clones, which in turn were the best out of 673 original selections on producer farms.

Planting systems

In a spacing and training trial on a black alluvial soil in the Hex River Valley it was found that increasing the row width from 2,4 m to 3,0 m or even 4,5 m did not have a detrimental effect on the yield. The wider row also has additional advantages such as easy access to the vineyard for tractors, trailers, spray rigs and implements.

Colour problems

The most important export table grape cultivar, Barlinka, is subject to poor colour in most of the Western Cape production areas. Trials during the 1973-1975 seasons showed that treatment with ethephon is not only an effective

method of improving colour, but that it also has various additional advantages in the handling of the crop. The greatest benefit is obtained by applying ethephon at 100 ppm 2 to 3 weeks before the first crop is expected.

Because of the advanced and more uniform ripening and colour development the crop can be harvested in fewer pickings and the harvesting season of large plantings can be spread by treating only parts of vineyards. The quality of Barlinka grapes after cold storage is not adversely affected by ethephon treatment.

Chemical control of mealybug

Two mealybug insecticides, methidathion and fenclorophos, were sprayed on a small table grape plot at low volume and ultra-low volume rates of application for the purpose of establishing the breakdown rate of the residues.

Analysing methidathion on the gas chromatograph was found to be impossible. In the case of fenclorophos it was found that, with the exception of one low-volume spraying, all residues had dropped below the tolerance of 0,5 ppm after 14 days.

Long-term storage

In South Africa table grapes are kept for the full duration of storage period in an atmosphere of 10 ppm of sulphurdioxide at a temperature of $-0,5^{\circ}\text{C}$ and a relative humidity of 85 to 90 per cent. Concentration control must be accurate and development of an automatic control device has created new possibilities.



Erlihane , a Hanepoot-flavoured table grape for the Summer Rainfall Area, has been bred by the Horticultural Research Institute

Trials have shown that Barlinka grapes can be successfully stored for four months in a cold storage chamber where the sulphurdioxide concentration is automatically controlled. It was also found that the maximum storage life of Waltham Cross is only two months. The quality of the grapes in both cases was high.

Maturity studies

The results of previous years were confirmed, namely that there is always a relationship between taste and sugar content, irrespective of cultivar, area or harvesting date. No clear relationship was found between maturity and keeping quality.

A method that ensures that representative samples are taken for maturity determinations was developed.

Control of spoilage

It was found that botrytis rot in table grapes can be effectively controlled by a combination of pre-harvesting and post-harvesting applications of fungicides. Packing grapes in polyethylene bags and treatment with metabisulphite solution produced grapes of the best quality after cold storage.

Oidium

It was found that oidium is able to survive on vine shoots that have remained green throughout the winter. Such shoots often occur, particularly in variable dry and wet conditions.

SUMMER RAINFALL REGION

Breeding

The Department decided to release the table grape strain HD/Q/HD 67-627 as the cultivar Erlihané. It is an early Hanepoot type table grape which ripens with Queen of the Vineyard, that is to say, at the end of December, at Roodeplaat.

Unlike Hanepoot, Erlihané is a strong grower and much more prolific. The bunches of Erlihané are also well filled and do not shatter as do those of Hanepoot. The grape is being released as a table grape for the Summer Rainfall Area where it has already been tested at various places.

Another table grape selection which again showed great promise is Q/BL 69-699. This grape looks very much like Barlinka, one of the parent vines, but ripens early in January. It has a better black colour than Barlinka, the Barlinka flavour, the strong skin of Barlinka and also its keeping quality.

This selection is one of the most promising table grape types bred at Roodeplaat to date.

Diseases

Seven cultivars and strains of table grapes bred at Roodeplaat underwent heat treatment for 128 days during the year under review. Among them were Pirobella and Golden City, which have already been indexed for five months on different indicators and have shown no virus symptoms so far.

Verticillium dahliae was isolated for the first time in South Africa from grape rootstocks of the cultivar St. George (*Vitis rupestris*). Although the fungus was repeatedly isolated from young vines which showed severe die-back, vines with similar symptoms from which the fungus could not be isolated also occurred. Infection studies are now being undertaken to determine whether the fungus is in fact the causative organism.

The heat treatment of the chief table grape cultivars grown in the Winter Rainfall Region, including Almeria, Alphonse Lavallée, Barlinka, Queen of the Vineyard, and Waltham Cross was continued and another 57 subclones were propagated. The indexing of established subclones has in some cases already progressed successfully for one season.

The heat treatment of table grape cultivars grown in the Summer Rainfall Region is already far advanced. This season 24 subclones of such cultivars as Hanepoot, Jakaranda, Pirobella and Golden City have been established. Established subclones of Muska have already had one season of successful indexing.



A technique for large-scale breeding of the Natal fruit-fly has been developed in the laboratory

WINE GRAPES

INTRODUCTION

The 1974 grape crop was 5 046 549 hl - 10 per cent less than the 1973 crop; 2 563 152 hl was good wine and the rest distilling wine. The indications are that the 1 million ton mark (6 000 000 hl) will be reached for the first time in history with the 1975 vintage.

It is possible that the new plantings of the past few years are already beginning to contribute towards the increase in the crop. The good winter and spring rains during 1974 also had a favourable effect on the 1975 grape crop. Vine mealybug began to assume serious proportions in some areas and for the first time in history downy mildew occurred on a fairly extensive scale in the Lower Orange River area during the post-harvest period.

Exceptionally good progress has been made with the demarcation of homogeneous viticultural areas. There is an encouraging enthusiasm among producers and wine-makers, and several requests for the demarcation of smaller subareas have already been received.

The system of area demarcation is obliging the Institute to make its research studies more area-orientated. The Institute has already laid out 20 different experiments on the evaluation of cultivars in the various areas.

The scarcity of high-quality vine propagation material was once again one of the greatest problems of the industry. The shortage of material is especially critical in the case of rootstocks like Richter 99 and 101-14, and everything possible should be done to overcome this problem. The scheme in terms of which the heat-treated material, which has also already undergone a final viticultural evaluation, and which will shortly be made available, is to be handled, is being finalised at present. The scheme will probably be embodied in legislation early next year.

If this certification scheme for vine propagation material could be successfully implemented, it would undoubtedly be one of the greatest advances in the history of the South African wine industry.

During the past year the Oenological and Viticultural Research Institute made four cultivars, viz Kerner, Weissler Riesling, Bukettraube and Heroldrebe available to the industry. A number of very promising rootstock cultivars, including Paulsen 1103 and Ruggeri 140, are in the final stages of evaluation.

The worsening labour shortage is creating increasing problems for the wine industry. With this in mind the Institute paid especial attention last year to research on the mechanical harvesting of wine grapes. Much valuable information has already been obtained from the first experiments.

Exceptional interest has also been shown by the public and the first big Farmers' Day held at Nietvoorbij was attended by more than a thousand farmers.

Apart from labour, water imposes the greatest restriction on the wine industry in the Western Cape. Irrigation research (together with various other projects) is therefore still high on the list of priorities in the Institute's research programmes.

A finding of exceptional economic significance for the traditional viticultural regions is that the crop can be doubled, by irrigating only twice, preferably once during the flowering of the bunches and again about a month before harvesting.

An event of exceptional significance during the past year is the adoption of the Groot Constantia Government Estate Control Act. A Board for Groot Constantia, which will operate more or less independently, has already been appointed by the Minister of Agriculture.

EVALUATION OF CULTIVARS (FIRST PHASE)

Imported scion cultivars

Another 34 cultivars and clones were imported, which brings the total number of imported cultivars and clones to 171. Of this number 130 were established at the trial plots of the OVRI. The others are still at the quarantine station of the PPRI at Stellenbosch, where they are undergoing the required pathological tests.

Experimental wines were prepared from 51 cultivars. The following produced table wines of above average quality: Bukettraube, Kerner, Weisser Riesling clone 055, Reichensteiner 18/92, Gewürztraminer (clone Davis), Sylvaner (clone Beier), Gm 11/34 and Gm 3/48, from all of which wines were prepared three or more times; Chenin blanc, Vital, Bourboulenc, Grenache blanc, Terret blanc, Azal branco, Rousanne blanc, Rüländer and Weisser Riesling clone 239, from which wines were prepared twice; Aramon blanc, Harslevelii, Galego farcadu, Nemesfurmint, Morio Muscat, Xarello cataluna, Elbling, Räuschling, Planta nova and Cataratto commune, from which wines were prepared for the first time.

Imported rootstock

A total of 58 rootstock cultivars, clones and *Vitis* species have been imported so far. Of this number 48 were established at the trial plots of the OVRI. The others are undergoing the required pathological tests at the quarantine station of the PPRI.

The following cultivars are being grafted for affinity and screening trials: Vivet 15, Castel 216/3, Castel 196/17, Prosperi Super Richter, Paulsen 1045, Paulsen 1103, Oppenheim 4, Grezot and Ruggeri 140, together with a few locally bred crosses of 99R and Jacquez.

SCION CULTIVARS IN FIELD TRIALS (SECOND PHASE EVALUATION)

In the evaluation of scion cultivars in field trials the white wine cultivar Steen produced a superior table wine at Nietvoorbij, and the new cultivars Bukettraube, Kerner and Weisser Riesling (055) all produced quality table wines. At Robertson superior table wines were also prepared from White Muscadel, Colombard and Kerner, which yielded 30, 24 and 14 tons per ha respectively. Bukettraube produced a quality wine despite its high yield of 32 tons per ha.

The red wine cultivars Cabernet Sauvignon (clone Davis), Heroldrebe, Sämling (11/1) and Alicante-Bouschet produced superior table wines at Nietvoorbij. The only red wine cultivars evaluated at Robertson were Pinot noir and Cinsaut. Their wines lacked colour and were of poor quality.

Release of cultivars

The following cultivars were handed over to the Wine Grape Multiplication Organisation of the KWV for multiplication and release to the wine industry: Bukettraube, Kerner, Weisser Riesling (clones 055 and 239), Chenin blanc, Chardonnay (ex Montpellier) and Heroldrebe. The number of imported cultivars made available to the wine industry during the past five years now amounts to 11.

Heat treatment of cultivars

A total of 76 scion cultivars and clones and 38 rootstock cultivars and clones underwent heat treatment at the virus unit of the PPRI at Stellenbosch during the past year. Heat-treated material of the standard rootstocks Richter 99, Jacquez, 101-14 and 143B was handed over to the Wine Grape Multiplication Organisation for multiplication. The material tested was found to be free of known harmful viruses.

NURSERY PRACTICES

Economic study

A survey of 87 vine nurseries revealed that the production costs for 1 000 marketable grafted vines were R98,50. One of the most striking findings of this study was the exceptionally high net income realised per hectare.

Because the nursery industry is labour-intensive, it is sensitive to a rise in labour costs. More judicious planning of labour and/or technological development, together with more efficient utilisation of labour in some areas, are a few possible ways of solving this problem. It will require capital-intensive innovations to stimulate technological progress in the industry but this study shows clearly that the industry as a whole can easily afford it.

The importance of a good percentage take, producing first-class vines, cannot be overestimated in view of the major influence it has on the

economic result of a nursery. The cost of producing 1 000 marketable vines for a producer with a 30 per cent take is about twice as high as for a producer with a 60 per cent take, whose net income would be about three times that of the producer who had a 30 per cent take. The extent to which the percentage take can be improved in future will depend largely on how much technological progress in the industry can be stimulated.

Improvement of grafting and nursery practices.

The conservation of the carbohydrate reserves and moisture content of the grafting material, as well as effective hygienic measures during grafting, form the basis of the modern scientific grafting techniques in the wine countries of Europe. The purpose of this investigation is to determine the most efficient grafting technique under South African conditions, in order to improve the quality and percentage take in the nursery.

The investigation showed that the European grafting techniques can be carried out with success in South Africa. Results which could be of great practical and economic importance to the nursery trade were obtained by storing the vines immediately after grafting, but before callusing, at 4°C for 40 days. The callusing and budding of the vines were above average and the highest percentage take of all the treatments was obtained in the nursery. This technique enables the nurseryman to start grafting early; consequently a larger number of graftings can be done and there is a better utilisation of labour. The storage of disinfected grafting material in plastic bags at 4°C before grafting also gave better results than outdoor storage in sand, whereas storage at 10°C in sealed plastic bags was catastrophic as a result of oxygen shortage in the bags at such a high temperature.

Chinosol at a concentration of 0,3 per cent seemed to be the most effective fungicide for disinfecting the grafting material without impairing callusing and growth. The waxing of the scion and union with Chinosol-impregnated, elastic grafting waxes at a temperature of 65 to 80°C also proved successful.

Cartonage

Important progress was made with the production of grafted vines in cartons under controlled conditions - "cartonage". This method enables the nurseryman to furnish growers with grafted plants the same year in which the grafting is done. The results indicate that the potting mixture in the carton is very important for adequate root development and growth. A potting mixture of one-third sandy soil and two-thirds peat moss gave the highest percentage rooting (98 per cent). When

sawdust was used in the potting mixture, the percentage take decreased rapidly.

The best results were obtained by transplanting the vines straight into the vineyard after the cartonage process and not into the nursery.

Waxing the scion and graft union after callusing and eliminating bottom heating during the cartonage process gave the highest percentage take (85 per cent) in the vineyard. A hardier grafted vine was obtained in this way. Because a number of vines are eliminated during the cartonage process, an 85 per cent take in the vineyard is equivalent to a 64 per cent take, calculated on the basis of the original number of graftings done. This is a great improvement on the usual 30 to 40 per cent take in the nursery.

CULTURAL ASPECTS

Soil cultivation

Results obtained so far show that the success of dry land cultivation is determined by the thoroughness with which natural winter weeds or cover crops, as well as summer weeds, can be destroyed or controlled. Covering the surface of the soil with a plant mulch is beneficial. There were also indications that chemical weed control over the whole soil surface compares well with conventional cultivation practices from both a technical and an economic point of view.

Irrigation studies

The first phase of research on the influence of irrigation on vine performance and wine quality has been completed. It was found that, in the Stellenbosch region irrigation during certain important physiological growth stages of the vine, such as pre-flowering, the green berry stage and the stage before ripening, boosts production considerably.

Where there is insufficient irrigation water the best results can be obtained by irrigating before flowering and immediately before ripening. If only enough water for one irrigation is available, it should be applied before ripening for the best results. Irrigation did not lower the sugar content of the grapes or delay ripening but it did cause a higher acid content in the must. The wines made so far have all been rated as quality wines. However, wines from irrigated grapes were not as well balanced, owing to their higher acid content.

This investigation also confirmed the supposition that considerably lower pan factors should be used in the case of wine grapes (approximately 0,25 during peak evaporation periods) than is generally accepted. In the case of permanent or micro-irrigation systems used on a short cycle basis, higher pan factors should be used.

Control of weeds

The primary weed problem in vineyards is annual and especially perennial summer weeds, which accelerate the drying out of vineyard soils, resulting in decreased growth and yields. Weed killers that are sufficiently safe and effective are the ideal means of replacing manual labour, which is more expensive and increasingly difficult to obtain. The phytotoxicity of 33 weedkillers was investigated by applying them at normal dosages to the roots (in sand culture) and also to the leaves of actively growing one-year-old vines. Of the weedkillers registered for use in vineyards, paraquat, diquat and simazine are the safest, after direct root contact, and amitrole, diuron, dichlobenil, MCPA and Dalapon the most harmful. The weedkillers glyphosate and nitratin, for both of which application has been made for registration, are also relatively safe after direct root treatment, and are comparable to Simazine. Simazine is the only one of the eight weedkillers registered for use in vineyards that is harmless when sprayed directly on the leaves.

Glyphosate is a new systemic weedkiller that can safely and very effectively be used for all perennial weeds in vineyards, including all species of quick-grass nutgrass (*Cyperus* spp), field bindweed (*Convolvulus arvensis*) and others.

The effect of soil type

Soil type is commonly considered an important factor which influences the quality of the grapes and vine. Experiments were conducted with a Steen vineyard at Vloottenburg, on the Avalon and Estcourt soil types.

Results show that soil type had no significant influence on either the sugar content of the grapes or the pruning mass of the vines. The part of the vineyard on the Estcourt soil type did, however, yield a significantly higher crop mass and acidity than the Avalon. There was no significant difference in the quality of the wines from the two soil types in either 1974 or 1973.

Vineyard, grape and must analyses of a Steen vineyard on Avalon and Estcourt soil types (1974)

Soil type	Pruning mass	Crop mass	Sugar	Acidity	Wine quality
	kg/vine	kg/vine	°B	g/l	%
Avalon	2,0	3,8	19,0	5,4	54,5
Estcourt	1,8	6,5	19,6	7,0	55,4

The finding that pruning masses differed only slightly, whereas crop masses were significantly higher on the Estcourt than on the Avalon Soil type, indicates that soil plays a dominant role, and that in this case production is not necessarily related to growth vigour. At this stage it seems that moisture and the effect of soil on moisture is an important contributory factor.

Mechanical harvesting of grapes

The results obtained with mechanical harvesters during the first year are summarised in this table. Normal hand harvesting was used as the control.

Test results of the mechanical harvesters

	Max.	Ave.	Min.		
1. Harvesting rate:					
(i) Machine (ha/h)	0,51	0,3	0,14		
2. Capacity (t/h)	7,0	4,56	2,19		
3. Field efficiency*(%)	95	73	58		
4. Machine losses (%)					
(i) Soil	3,86	2,63	1,4		
(ii) Vine	8,25	2,93	0,39		
(iii) Juice	16,0	7,46	2,57		
(iv) Stalks	6,0	3,98	1,55		
Total	29,11	16,91	11,86		
5. Hand harvesting losses (%)	8,79	5,26	1,56		
6. Defoliation (%)	56	45	18		
7. Composition of machine-harvested grapes %					
(i) bunches	24,4	9,5	1,0		
(ii) berries	86,0	77,0	67,0		
(iii) juice	30,2	12,4	5,8		
(iv) debris	2,9	1,2	0,4		
8. Vine damage (position of spurs according to the clock)	12h	1h	2h	3h	4h
Percentage damage	4,46	8,13	14,87	18,05	10,73

*Field efficiency refers to the time the machine was actually picking grapes expressed as a percentage of the total time during which the machine operated, which includes time spent in turning etc.

It must be taken into consideration that the results were obtained only during a period of one season. Secondly one must keep in mind that South African vineyards have not yet been adapted for mechanical harvesting. The results are very promising and greater efficiency can be expected with better adapted trellising systems.

The maximum harvesting rate was obtained where the vineyard layout was planned for mechanical harvesting, that is long rows and a trellising system which is not too low. The harvesting rate was lowest where the shoot growth was very dense and uncontrolled (1,5m fence system). These harvesting rates should be compared with a hand harvesting rate of approximately 0,156 t/man hour. The harvesting capacity as well as the field efficiency was the highest with the 1,6m extended Perold system, which is considered to be the most suitable for mechanical harvesting. Two other factors which have an influence on the efficiency of the machines are the slope of the land and the production of the vineyard. The efficiency was very low on steep slopes, and was highest on a vineyard with a good yield on level ground.

Damage to the grapes and harvesting losses are closely related to the slope of the land and

particularly to the trellising system. The biggest loss, namely the loss of juice is higher on slopes, since the juice runs off the extractor plates. Juice is also lost when the extractor fans separate loose leaves from the harvested grapes.

The vine itself has an influence on the amount of wastage. Crooked and double trunks give rise to bigger losses. Losses were lower with upright trellising. As indicated in the table, hand harvesting losses can also be relatively high, depending on the diligence and reliability of the working team, the supervision exercised, the trellising system and the cultivar. Defoliation can be minimised by using a trellising system that keeps the leaves out of the reach of the beaters, so preventing them from being damaged.

Damage to the vines can be decreased to a great extent by using the correct pruning system. The basic object must be to prune all the spurs in a vertical position as far as possible.

GROWTH ARRESTMENT DISEASE (GAD) INVESTIGATIONS

Soil investigations

The initial collection of data for this project, which has taken three seasons, has been completed. According to the information gathered, there was a tendency for "diseased" soils to have a heavier texture than "healthy" soils. The potassium content was lower and the sodium content higher in diseased soils than in healthy soils. This situation was also reflected in plant analyses. Over a three-year period no relationship between cultural practices and the occurrence of the disease could be found.

Microbiological investigations

During 1973 and 1974 an intensive study was made of vineyard soils from the Upington area. The object was to determine whether the micro-organisms in the vineyard soil at Upington are in any way related to, or are a contributory factor in, growth arrestment disease.

The survey revealed that, as a result of regular flood irrigation, the nitrate nitrogen content and the nitrification of the trial soils were relatively low in comparison with similar fertile soils. By adding nitrogen the conversion of organic matter can be increased by 40 per cent, but nitrogen fertilisation seems to be unnecessary judging from the abundant vegetative growth of the vines.

During March 1974 the test plots were submerged in 2 m of water. Nevertheless the results indicated that the microbial activity of the vineyard soil was in no way impaired. Accurate statistical evaluation of the microbiological data collected over a period of 14 months showed that soil microbes and their activity do not play a part in growth arrestment disease.

Resistance of vine rootstocks to

Phytophthora cinnamomi

Twenty-one different vine rootstocks were tested for resistance to *P. cinnamomi* in water culture and soil medium.

Results showed that no rootstock can be classed as immune from infection by this root pathogen. There are, however, differences in the susceptibility of the rootstocks. Of the commercially important rootstocks Richter 99, 101-14 and Metallica are classed as highly susceptible, Richter 110 and Rupestris du Lot are fairly susceptible. Jacquez, Salt Creek and 3306 are moderately susceptible and 143-B fairly resistant. Not one of the new rootstock cultivars and crosses was classed as highly susceptible.

Results of the new rootstock cultivars as well as the new crosses show that Paulsen 1103, Paulsen 1045, Ruggeri, K2-1, K3-6, K3-5, Maleque and 7/3 are all fairly susceptible. Prosperi Super Richter is slightly less susceptible whereas Grezot is the only new rootstock which was classed as fairly resistant.

Crown gall

A survey was carried out in the Western Cape on the incidence of *Agrobacterium tumefaciens* in Richter 99, both rooted and grafted rootstocks. Preliminary results indicate that there is a high percentage infection and emphasise the problem of distinguishing between callus tissue and infected material. One hundred and sixty-five nurseries were involved in this investigation.

PEST CONTROL

Phylloxera

Rootstock resistance - Various phylloxera-resistant rootstock cultivars were planted in an infested plot in the Stellenbosch area. Eight years afterwards the resistance of Richter 99, Rupestris du Lot and 3306 was found to be very good. Although Jacquez is used most commonly in practice, its resistance to phylloxera was found to be very poor. Consequently this cultivar should not be planted in phylloxera-infested soils in the Stellenbosch area.

At the age of eight years the cultivars being tested for resistance can be classified as follows:

1. Very good: Richter 99, Rupestris du Lot and 3306
2. Good: Dogridge, 143-B, 101-14, Teleki and 333
3. Poor: Salt Creek, 420-A and Fairy
4. Very Poor: Jacquez

Chemical control

In the Vredendal area, disyston and Namacur at dosages of 25 and 50 kg/ha each were found to be ineffective for the control of phylloxera. Hexachlorobutadiene at a dosage of 360 kg/ha gave 100 per cent control during two successive seasons and 73 per cent control, during the third season.

In the Stellenbosch area hexachlorobutadiene



at a dosage of 250 kg/ha gave 100 per cent control against phylloxera for three successive seasons. During this period it also gave effective control (83 per cent) at a dosage of 150 kg/ha, but it was ineffective at a dosage of 75 kg/ha.

The effect of this chemical on the production and vigour of the vines is not yet clear and further investigations are needed before any recommendations for general use can be made.

Margarodes

Sphaeraspis capensis, which attacks vineyards in the Malmesbury area, was studied under laboratory conditions. Adult females were found to emerge from the cysts from the middle of January to the beginning of March. Only five to ten per cent of the cysts develop into females each year and apparently the cysts can remain in a quiescent stage for long periods.

The average life-span of females is 24 days. The average period from the emergence of females from cysts until oviposition starts is 9 days. The average period of oviposition is 11 days, during which an average of 251 eggs are produced per female. The average period after oviposition to the death of the female is 4 days.

It was determined that this species reproduces parthenogenetically and that the females do not migrate to the surface of the soil for mating.

Nematode control

Observations of field experiments on the response of established vineyards to treatment with nematocides were continued. In one trial at Upington the reduction in population levels of *Meloidogyne*, *Tylenchulus* and *Macroposthonia* species was still statistically highly significant 116 weeks after treatment with two emulsifiable formulations of DBCP at dosages of 58 kg a.i. per ha. The populations of other nematodes have largely recovered. Both treatments produced a significant increase (25-29 per cent) in the yield.

Similar trends were observed in a second trial in a neighbouring vineyard, although the severity of the symptoms of growth arrestment disease was not affected. It therefore appears that nematodes are not a cause of this disease.

An investigation was carried out in a year-old vineyard in Robertson to determine the effect on nematodes of the black polythene covering that is sometimes used to establish young vines. Soil samples were taken near vines established with and without polythene. No significant differences were found in the population levels of any important plant parasitic nematode species.

CELLAR TECHNOLOGY

The effect of grape transportation on wine quality

Further tests carried out with the cultivars Steen, St Emilion and Colombard to evaluate the



The attenuation plate counting method is used for determining the number of viable organisms in bottled wine.

effect of grape transportation at high temperatures on the quality of wine showed that wine quality was impaired only if the grapes were of low quality.

It was established that transportation *per se* had no effect on grape quality, and consequently on wine quality, even at high temperatures, provided the grapes were healthy and not unduly damaged in transit.

The effect of botrytis rot and traumatic ripening (bevange rypheid) on the quality of wine

It became necessary to carry out this investigation because winery managers, who use the physical condition of grapes as a criterion for determining the price, are not sure what percentage of botrytis rot and traumatic ripening impairs wine quality.

Tests were carried out in which the juice of rotten Steen grapes was mixed in quantities of 0 per cent, 5 per cent, 10 per cent, 15 per cent and 25 per cent with the juice of healthy Steen grapes and fermented to wine. Similar tests were carried out with mixtures of the juice of Steen grapes that had ripened abnormally and normally. The results showed that wines made from grapes containing 15 per cent or less botrytis rot were not significantly different in quality from those made from healthy grapes.

Wines made from grapes more than 25 per cent of which showed traumatic ripening had a

marked bitterness which got progressively worse as the percentage of traumatically ripe grapes in the mixture increased.

These tests proved that wine quality was negatively affected only if the wines were made from grapes that had a relatively high percentage of botrytis rot or prematurely ripe grapes in the mixture.

The effect of mechanical harvesting on wine quality

It is of primary importance to investigate wine quality when using new machines for wine-making. With this object in mind, tests on wine grapes that had been mechanically harvested were carried out during the past season.

The cultivars Steen, Colombard, Clairette blanche and Pinotage were mechanically harvested in the Riebeek-Kasteel, Stellenbosch, Rawsonville and Ashton regions.

Selected plots of the same cultivar, about half a hectare in size, were used; the rows were cropped alternately by hand and machine.

The cropped grapes were transported to the nearest co-operative winery, immediately destalked and in the case of white cultivars, dejuiced. The juice fractions of the hand and machine cropped grapes were taken to the experimental wineries at Nietvoorbij, and fermented by the standard procedure.

In the case of red grapes the mash was taken to the experimental wineries to undergo further

processing. The temperature of the grapes at harvesting time, the contamination of the harvested grapes by leaves, stalks and pieces of cane, called MOG (material other than grapes), the percentage of broken berries and the amount of liberated juice as well as the skin contact time of the harvested product from the time of cropping to dejuicing are all factors that influence the quality of the wine made from mechanically harvested grapes.

This study comprises an investigation of the influence of all these factors on wine quality.

These tests showed that in the case of white wine cultivars, the mechanically harvested product contained about a 50:50 ratio of whole and broken berries and that the amount of juice liberated during harvesting depends on the suitability of the cultivar for mechanical harvesting. The latter is probably determined by the trellising system of the vines.

The amount of MOG in the harvested product varies from cultivar to cultivar and is probably determined by the trellising system and the suitability of the cultivar for cropping by the machine.

Results of the must analysis and wine evaluation of machine- and hand-harvested grapes are summarised in the table below.

The best white wine of the test series was made from machine-picked Steen in the Riebeek-Kasteel region and was significantly better than the wine from hand-picked grapes. The machine-picked Colombard wine from Ashton was significantly better than the wine from hand-picked grapes.

The higher quality of the wine made from machine-picked grapes can be attributed to the advantageous effect of a longer skin contact time under fairly favourable conditions of temperature and must composition, especially with regard to the good acid content.

In comparison, the machine-picked Steen from Malmesbury and Clairette blanche from Rawsonville yielded wines which were significantly

lower in quality than those made from hand-picked grapes.

The lower wine quality from machine-picked Steen from Malmesbury can be attributed to an exceptionally long skin contact time (200 minutes) coupled with abnormally high grape temperatures (29°C). In the case of Clairette blanche from Rawsonville, both the skin contact time and the grape temperature were more or less the same as those of Steen from Riebeek-Kasteel. The difference must therefore be sought in the very low acid content of the Clairette blanche must (4,8 mg/l) since skin contact with grapes with a low acid content is known to impair the quality of the wine.

As regards the Steen from Rawsonville and the Pinotage from Riebeek-Kasteel and Stellenbosch, no significant differences in the quality of wine made from machine- and hand-picked grapes were observed. In the case of red wines where skin contact is a normal part of wine making it is logical to suppose that skin contact time from harvesting to pressing has virtually no effect on wine quality. It is therefore evident that red wine cultivars in general can be machine-harvested without affecting the wine quality to any great extent.

With regard to the mechanical harvesting of white wine cultivars, it seems that wines of exceptional quality can be produced from machine-harvested grapes, as long as the acid content of the must is high, the skin contact time does not exceed 100 minutes and the grape temperature during harvesting is as low as possible. It is therefore preferable to harvest early in the morning or late in the afternoon.

Must analysis and wine evaluation of mechanically harvested and hand-harvested grapes - 1975 vintage

Region	Riebeek- Kasteel		Malmesbury Stellenbosch		Rawsonville		Ashton
Cultivar	Steen	Pinotage	Steen	Pinotage	Steen	Clairette blanche	Colombard
MOG % (machine harvesting) (Material other than grapes)	0,6	0,4	1,0	1,2	0,8	0,8	2,9
Grape temperature during harvesting	24,5°C	24°C	29°C	27°C	23°C	23,5°C	27°C
Skin contact time (mechanical harvesting)	94	90	200	80	80	80	85
Must analysis (mechanical harvesting)							
Sugar	20,4	23,9	22,1	24,5	20,3	18,4	21,0
Acid	7,1	8,4	7,1	6,7	6,7	4,8	10,0
Wine evaluation points %							
Mechanical harvesting	70,5	71,9	27,2	68,7	62,7	57,9	56,6
Hand harvesting	61,3	67,3	61,6	71,7	63,0	67,7	33,3

Potassium sorbate as a wine preservative

To evaluate the efficiency of potassium sorbate as a preservative, semi-sweet wines treated with sulphur dioxide and potassium sorbate were inoculated with three yeast species (*Saccharomyces cerevisiae*, *S. acidifaciens* and *Pichia membranaefaciens*), bottled and periodically tested for yeast growth.

The results indicate that secondary fermentation can not be prevented solely by the addition of SO₂ (in this case 80 and 150 mg/l). When using both SO₂ and potassium sorbate a fungicidal effect can be observed. The efficiency of the fungicidal action depends on the amount of SO₂, however, since absolute sterility was obtained only by using 150 mg of SO₂/l and 130 to 200 mg of sorbate/l of wine. With a total SO₂ level of 80 mg/l, absolute sterility was not obtained but at doses of 200 mg of potassium sorbate/l and more the original yeast inoculum was reduced by over 99%.

Because a yeast concentration of 100 000 cells/cm³ of wine was used (a concentration not found in a winery), a semi-sweet wine with a total SO₂ level in excess of 80 mg/l and more can be adequately preserved by the addition of 200 to 264 mg of potassium sorbate/l of wine (1,34 mg of potassium sorbate $\frac{1}{4}$ l mg of sorbic acid).

Good wine recovery and must purity

The influence of settling and centrifuging on good wine recovery and wine quality was investigated at the request of the industry.

Centrifuging gave better results than settling for both Steen and White French cultivars. The velocity of centrifuging, i.e. the degree of must turbidity, did not impair quality significantly.

WINE CHEMISTRY

Specific aroma components

Aroma components are important factors in determining quality in wines. Last year dimethyl sulphide (DMS) was identified in wines and defined as an aroma component. A gas chromatographic method of determining DMS quantitatively was developed.

It is evident that DMS is largely responsible for the maturation bouquet of white wines and contributes to quality in this way. It develops solely with age and is also influenced by the cultivar, as the following table shows. The identification and analysis of one wine bouquet component will contribute significantly to the precise analysis of wine quality - an international objective.

Influence and occurrence of esters

Last year it was determined that the ethyl octoate concentration of Steen wines made from grapes harvested at different dates showed a highly

Dimethyl sulphide concentration (mg/l) in wines of different cultivars and vintages

Cultivar	Vintage year		
	1974	1973	1972
Steen	0	12	27
Colombard	0	40	46
Riesling	-	-	474

significant correlation with wine quality.

The study was repeated and confirmatory results obtained (see table below).

Wine quality and ethyl octoate concentrations of Steen wines

Harvesting date	Wine quality %	Ethyl octoate mg/l
Jan. 28	41	1,35
Feb. 4	52	1,45
Feb. 12	56	1,77
Feb. 18	64	1,84
Feb. 26	58	1,59

This work is of great importance in that it makes it possible to replace subjective judging of wine quality by more objective methods.

LIQUOR CONTROL

Wine certification scheme

Table 1 shows the quantity of wine examined and certified by the Wine and Spirit Board during the year under review for purposes of sale under the Board's seal, with an indication of its origin, cultivar or vintage.

TABLE 1 - Certification of wines of origin, cultivar and vintage wines

	Number of applications	Volume (hectolitres)	% Certified according to volume)
Total wine examined	594	109 355	-
Total certified	557	105 846	96.8
Superior quality	47	3 699	3.5
Average quality	510	102 147	96.5

The supervision of certified wines starts from the pressing of the grapes for the production of each wine and continues until the wines are finally certified; in the course of this process 2 868 samples of wine were evaluated and graded on a quality basis by the Wine and Spirit Board. All such samples also underwent chemical analysis in the routine analytical laboratory of the OVRI.

The total volume of wine certified under this scheme represented 4,1 per cent of the 1974 good wine crop and 5,4 per cent of the total local consumption of unfortified wine (including sparkling wine) during 1974. Corresponding figures

for 1973/74 were 3,6 per cent and 5,2 per cent respectively. Sixty per cent of the wines placed in the superior quality class were red wines.

Fifteen larger areas and 35 wine estates have been registered so far in terms of Act 25 of 1957 for the production of wines of origin and estate wines.

Control of export liquor

In all 1 768 applications, representing 153 915 hectolitres of alcoholic beverage, were examined and evaluated on a quality basis by the Wine and Spirit Board in terms of the Liquor Export Regulations. At the same time 2 287 samples of export liquor were subjected to chemical analysis in order to determine whether the liquor complied with the analytical requirements laid down in the regulations.

A total of 153 690 hectolitres (99,8 per cent of the quantity submitted) was certified as suitable for export. This represents an increase of 2,7 per cent over the quantity exported during the previous year, which should be attributed mainly to increases of 39,8 per cent and 7 per cent in bulk exports of sherries and other fortified wines, respectively.

Certification of rebate wine, rebate brandy and wine spirits

The Government Brandy Board examined 4 357 samples for quality.

Table 2 gives a summary of the results.

TABLE 2 - Certification of rebate wine, rebate brandy and wine spirits

Type of wine or spirits	Total examined (samples)	Total examined (hectolitre)	Approved hectolitres	% Rejected (volume)
Rebate wine	2 630	1 092 919	1 076 654	1,5
Rebate brandy	445	105 050	103 336	1,6
Wine spirits	794	263 851	261 178	1,0
Low-strength spirits	169	36 907	34 992	5,2
Spirits for fortification of wine for vinegar production	9	2 999	2 640	11,9
Raw spirits	244	59 400	none	100,0

It is striking that the quantity of rebate wine approved during the current year was 116 per cent more than during the previous season. Although most of this wine had not been distilled into rebate brandy by the end of the year under review, the volume of export brandy certified by the Board so far is already 54 per cent higher than last year.

It was also striking that only 1,5 per cent by volume of the rebate wine submitted was rejected, compared with rejections of 18,4 per cent, 22,5 per cent and 22,1 per cent, respectively, during the previous three seasons.

Inspection of licensed premises

During the current year liquor inspectors appointed under Act 25 of 1957 travelled 65 682 kilometres and inspected 1 506 licensed premises. Out of a total of 72 227 liquor samples subjected to preliminary tests and inspected for labelling at those premises, 93 suspected samples were submitted for further examination and chemical analysis by official analysts appointed under the Act. The result was that 7 licensees were prosecuted for adulteration of liquor.

Two of them were found guilty and fined. In one instance admission of guilt and payment of the analyst's fees were accepted by the court. Four court cases are still pending. Twenty-three liquor licence holders were warned about minor infringements of the Act.

Control over imported liquor

Control over all imported liquor in terms of the Liquor Import Regulations is exercised in close collaboration with the Department of Customs and Excise.

A total of 2 143 samples of liquor were examined, 1 639 of which were subjected to chemical analysis and checked in respect of the labelling requirements of the Act. The balance of 504 samples were only examined for correct labelling.

Routine analytical services

The Routine Analytical Section of the OVRI is the only officially recognised laboratory in the Republic for the analysis of alcoholic beverages. It is recognised by foreign importing countries as being competent to issue certificates of analysis for all South African liquor exported to those countries. Similar services are rendered to various other Government Departments such as Customs and Excise and the South African Police. During the year under review 9 645 liquor samples were analysed.

New legislation

The Wine, Other Fermented Beverages and Spirits Amendment Act, 1974 contains certain additional provisions which are aimed chiefly at the better functioning of the Wine and Spirits Board and at the more effective application of the wine certification scheme in general.

It also provides for more rigorous control over imported liquors in general, and includes certain provisions relating to labelling, particularly with regard to indications of origin, vintage and cultivar on the labels of imported wines.

CITRUS

Breeding and selection

Growing point grafting has an important advantage over cultures of nucellus tissue and seed propagation as a method of eliminating viruses

from citrus clones. This technique is now being applied successfully at the Citrus and Subtropical Fruit Research Institute.

Success has already been achieved with Shamouti and grafts of Greathead navel and Hall's Valencia have taken although they have not yet developed.

As soon as sufficient growth has been obtained from the grafts, this material will be indexed for the viruses with which the source of graftwood is infected, namely exocortis and xyloporosis.

By this method viruses can also be fairly easily eliminated from *monoembryonic* clones. In such cases seed propagation is of no use and there is only limited success with nucellus cultures.

Lane Late navel

The Lane Late navel from Australia has also aroused great interest in South Africa. This selection was discovered on the farm of Mr Lindsay Lane of Curlwaa and brought to the attention of horticulturists, in particular because the fruit ripens much later than other navels - at the time when Valencias first change colour. The fruit is larger than other navels and hangs particularly well without developing the over-ripe taste that the Washington navel does in these circumstances.

Negotiations for the importation of seed of this cultivar into South Africa began in 1972 and about 60 seeds were received early in 1973. The seed was planted at Messina, Nelspruit and Addo. Germination was good and the trees are now about 1 and a half metres high. Buds of ten of the seedlings were separately top-worked on to adult, cut-back trees in order to speed up fruit production of the Lane Late and to evaluate this cultivar under local conditions. Fruit should be obtained within a year or two of these top-workings. Experimental plantings which include this selection are already under way in four areas.

In addition to the Lane Late, seed of more than 40 citrus and related species was imported for evaluation.

Breeding for resistance to black spot

About 250 Bitter Seville x lemon crossings have already been established in an orchard for later evaluation in respect of resistance to black spot and horticultural value. One of these crossings has already produced fruit this year.

In the case of breeding for a black spot resistant grapefruit about 200 crossings have been established, most of which were top-worked on to cut-back adult trees to accelerate fruiting.

The Citrus Improvement Programme

This scheme, which is a joint effort by the Department and the SA Co-operative Citrus Exchange, has made good progress. Altogether 227 graftwood trees selected during 1973 and 1974 have already been indexed for exocortis. Fruit quality

tests were carried out on 205 trees in 1974.

The trees, as selected, were graded into three groups, namely:

1. Potential candidate trees

When a tree, which must be at least 10 years old, is selected in the orchard by the owner for production, fruit quality and shape, tree size and general state of health and is then selected by the Improvement Scheme Committee, it is called a potential candidate tree and is marked as such.

2. Candidate trees

After potential candidate trees have been visited for at least two seasons and approved on the basis of sustained production, fruit quality, fruit shape, and so on and after the results of at least the exocortis indexing are known, the tree can qualify as a candidate tree.

3. Propagation blocks

Each nurseryman must establish a number of propagation blocks by budding on to suitable rootstock buds from candidate trees. These propagation blocks will be used for a period of not more than two years as a source of budwood.

Questionnaires were sent to all nurseries participating in this scheme posing pertinent questions about nursery matters. This information was used to evaluate nurseries. When next visited, each nurseryman was informed of his shortcomings and given the opportunity to correct them. If no correction follows, steps against the nursery are considered.

Methods of planting

Training and hedging

In view of the shortage and cost of labour, dwarfing of trees is receiving increasing attention today. There are various known methods of dwarfing. Initially chemical methods of virus infection is not being considered, but dwarfing of rootstocks, certain methods of planting, and pruning practices are.

A trial planting was established during 1973 in which Frost nucellar Lisbon lemons on both *Poncirus trifoliata* and Cairn rough lemon rootstocks are being trained on wires. Various methods of training are being applied.

The results will show whether this method of planting will be labour saving and facilitate greater mechanisation.

Oblique planting methods

Arising from results obtained in Sicily, a trial planting was established in which the rootstocks were planted at an angle of 45 degrees. The result is a slanted tree, which results in dwarfing. Ten-year-old lemon trees in Sicily are only 1,5 m high.

In the trial *Poncirus trifoliata*, Troye citrange and Empress mandarin were used as rootstocks.



The training of citrus trees and hedge pruning

Three cultivars, namely, Marsh grapefruit, Frost nucellar Lisbon lemon and Olinda nucellar Valencia were included in the trials. The trees were spaced at 1,0 x 1,2 m, which gives a density of 8 300 trees per ha.

The rootstocks were established in the orchard as seedlings and budding was done *in situ*.

Cultivation and fertilising

Chemical weedkillers through microjets

One of the less favourable consequences of microjet irrigation is the abundant weed growth which takes place in the irrigated areas, particularly around young trees. Since weeds cannot be controlled mechanically in the immediate vicinity of the tender stems, and because hand labour is hazardous, attempts were made to apply a registered contact herbicide, Paraquat, through a microjet irrigation system.

One-year-old citrus, avocado, mango, litchi and macadamia trees were first sprayed with Paraquat at four times the recommended concentration (one per cent product in water) in a preliminary trial. The trunks were thoroughly wetted to a point 250 mm above ground level.

Apart from severe symptoms on the leaves which were accidentally directly wetted, no symptoms developed either on the stems or the remaining leaves of the trees.

From the preliminary observations it seems reasonable to conclude that weeds can be effectively controlled by means of microjet irrigation. It also appears that the method is perfectly safe.

Applying the herbicide at a concentration of 4 litres per ha, the cost per tree amounts to 1,25 cent. At an estimated application frequency of seven times per year, it should be possible to control weeds at 9 cent per tree per year. About 15 minutes is all that is required to apply herbicides to 300 trees. Using a tractor and spray pump the same operation would take about 9 hours.

Nutritional requirements of citrus

Experiments revealed that mature lemon trees require relatively small amounts of nitrogen and that excess nitrogen can cause a decline in yield. Optimum yield was obtained with 1,5 kg of limestone ammonium nitrate (30 per cent N) and was associated with a leaf N-content of not more than 2,3 per cent N. Increased applications of nitrogen caused smaller fruit, but had no effect on

rind thickness, juice and acid content and total soluble solids of the juice.

A leaf P-content of 0.11 per cent was adequate and no direct P-effect on yield was obtained with increased P-applications when 8 ppm resin-extractable soil-P was present in the top soil (0-20 cm). However, when K-applications were increased, additional phosphate was also required. The acid content of the fruit juice was reduced by increased P-applications. No other significant effect of P-applications on fruit quality was observed.

As far as potassium was concerned the highest yields were obtained with a leaf K-value of 0.9 per cent. With an exchangeable soil K-value of 100 ppm K, a K-reaction with increased K-applications can be obtained. However, when the soil-K was increased to 220 ppm no additional potassium was needed. Increased K-application levels increased fruit mass, thickness of the rind and acid content of the juice.

Juice content of the fruit, which is the most important quality factor for export lemons, was not affected by any of the fertiliser treatments.

External fruit quality

Pock-marked peel

Rejections of citrus fruit for pock-marked peel have increased drastically over the past few seasons. These rejections amounted to 1.0 per cent of the total citrus crop in 1973 and rose to 2 per cent for the 1974 season.

Early cultivars such as Protea and Tomango are particularly severely affected, although a considerable quantity of Valencias are also condemned.

The problem is fairly similar to oleocellosis and is definitely related to the handling of the fruit during harvesting and packing. Climate is also involved and it appears that cold nights and a high relative humidity, in particular, may be factors which lead to the development of the symptoms.

Pock-marked peel is basically similar to oleocellosis in the sense that it is not superficial damage of cells, but internal damage. Pock-marked peel seems to occur over a large area between the oil glands.

It appears that, as in the case of oleocellosis, handling may play an important part in regard to pock-marked peel. Packing sheds where the handling of fruit receives careful attention have far less pock-marked peel, oleo, injuries and related problems than others in the same area.

No fruit with pock-marked peel has yet been observed in an orchard or on the belt in the packing shed. Pock-marked peel usually only appears some days after harvesting, therefore it is found in fruit at the port or in storage. In addition, it seems that climate, particularly cold nights, may influence the development of pock-marked peel symptoms.

Pests and diseases

Greening disease

As all attempts at isolating the causal agent of greening disease have failed, transmission electron microscopy was used to compare the ultrastructure of the greening organism with that of other known pathogens. It was found that the cell-wall ultrastructure of the greening organism bears a close resemblance to that of the Gram-negative bacteria in that it consists of a triple-layered outer structure separated from the cytoplasmic membranes by an electron transparent zone.

The similarity is not complete, however, since the greening organism has no obvious mucopeptide layer in the cell wall as in the case of the Gram-negative bacteria. This specific difference is further reflected in the fact that the greening organism is not sensitive to penicillin, an antibiotic which acts on the mucopeptide in the wall.

These findings are being applied in the search for culture media and conditions which will facilitate the culture of the greening organism, the ultimate aim of this research being to find an antibiotic which will be completely effective in controlling greening disease.

This research has so far revealed that tetracycline hydrochloride, when injected into infected trees, can significantly decrease the level of infection for several years. Spectrofluorometric residue analyses have revealed that the tetracycline is completely degraded within the plant tissues in 7 to 14 days and the persistent low level of infection is due to the very slow proliferation of the infective agent in phloem. Rapid reproduction of the greening organism in plant tissues seems to be limited to the phloem of very young tissues.

Virus indexing

Indexing of budwood candidates for the citrus improvement programme is not only providing the necessary service, but it is also providing a census of the disease status of our budwood sources for commercial tree production.

To date only exocortis has been indexed for, and about 20 per cent of the candidate trees have been shown to be infected. Budwood sources will also be indexed for xyloporosis, impietratura and psorosis. As new virus diseases become important, they will be included in the indexing programme.

Phytophthora resistance

Various rootstocks are being screened for their resistance to *Phytophthora parasitica* and several chemicals are being tested for their efficacy against this organism. One aspect of this research has revealed that tree surgery followed by the application of the fungicide Captafol is very effective in controlling gummosis.

Phytosanitary experiments

False codling moth. With the recent expansion of overseas markets in the Far East it has been necessary for phytosanitary reasons to find methods of freeing fruit of live insects. The fact that the Plant Quarantine Division of the United States Department of Agriculture already has an accepted schedule for fumigation of citrus with EDB for control of fruit flies led to the use of this material in combination with cold storage in a new series of experiments.

The results indicate that day-old eggs are somewhat resistant to the treatment of 16 mg of EDB/litre/2 hours plus 21 days cold storage at 11,1°C and also the gas treatment plus 25 days at 11,1°C. However, in all the above cases, although the larvae hatched during cold storage, they were unable to survive the cold treatment and 100 per cent mortality of the hatched larvae occurred. On the basis of the results obtained, EDB fumigation at 16 mg/litre/2 hours, followed by cold storage at 11,1°C for 21 days, is recommended as an effective procedure for the control of FCM in citrus.

Future trials will be carried out to determine whether the optimum storage temperatures for citrus fruits, alone or in combination with EDB fumigation, are adequate to kill off all stages of FCM in citrus fruit.

Fumigation for the control of fruitflies

The results confirm that EDB fumigation at a dosage level of 16 mg/litre for 2 hours is adequate to kill fruit fly larvae present in citrus fruits. Mortality sets in soon after the fruit has been fumigated. The mortality progresses from 19,5 per cent 29 hours after fumigation to 100 per cent after 87 hours.

Red scale and mussel scale

Very satisfactory results were obtained with the biological control of red scale and mussel scale on Valencias in the Nelspruit area. Where no sprays for scale had been applied for two to three years, less red scales and mussel scales were found than in the case of a single parathion spray.

The results again stressed the importance of applying adequate control measures for rust mite and flat mites.

Citrus thrips

The use of soil systemics has been tested for two seasons in the field and very promising results have been obtained. Dimethoate is the most promising material tested to date and has given up to 12 weeks of protection against thrips attack with a single treatment. As such systemics are applied in irrigation water, they make the purchase of expensive spray machines unnecessary, and are suitable for use in biological control programmes.

Several foliar sprays were tested against thrips at Rustenburg. Where thrips markings on navels were graded very strictly because of low

infestations, triazophos gave consistently good results, tartar emetic gave good results in most cases (when used as a bait with sugar), while phenthoate was usually the least effective.

The results of a few experiments with monocrotophos against thrips were promising.

None of these treatments caused a serious increase of red scale, but two sprays of phenthoate tended to increase the citrus red mite rather severely.

Citrus bud mite

A single spraying with Akar (chlorobenzilate) during January 1974 on 25-year-old navel trees where bud mite is permanently kept at an economic level produced significant differences between treated and untreated trees as regards yield and damage.

In the trial in which bud mite is controlled more new growth was formed than on untreated trees.

Where yield and damage to fruit were the yardstick, it appeared that the optimal period for the application of control measures against bud mite in navels lasts from December to May.

Citrus red mite

Red mite remains a less important pest in unsprayed orchards, mainly as a result of natural control factors, the most important of which are climate and predators (insects and mites). Exceptionally high temperatures combined with low moisture conditions are detrimental to red mite, with the result that outbreaks of red mite are restricted to the early summer, autumn and early winter.

In the absence of toxic sprays the predatory mite *Amblyseius citri* is able to keep red mite populations at a low level throughout the season. As soon as the predatory mite is eliminated the red mite increases to large numbers on the trees. It is then usually the insect predators (Stethorus, Chrysopidae and Coniopterygidae, particularly the last) that control the red mite populations, but generally not before some damage has occurred.

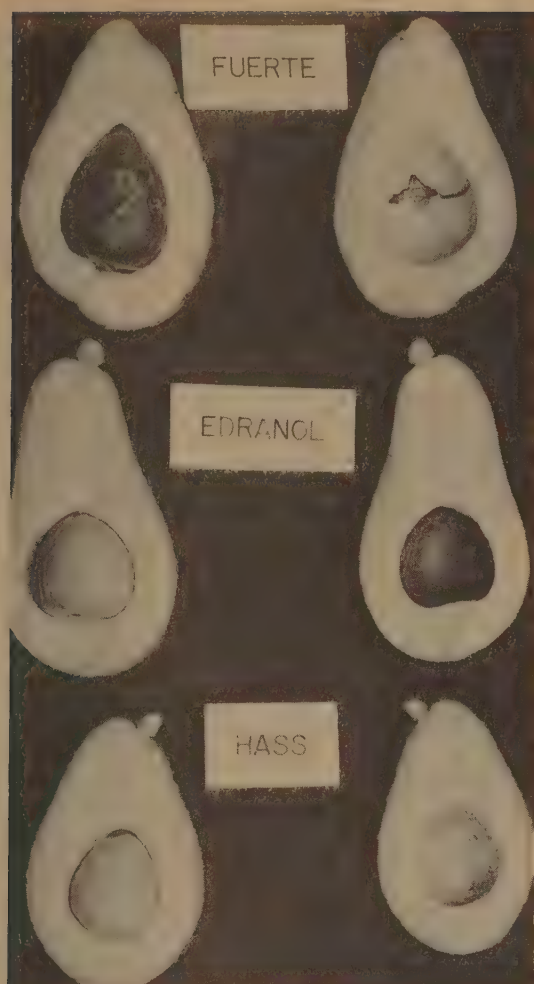
SUBTROPICAL FRUIT

AVOCADOS

A number of promising new cultivars were imported during the past year and are being tested in trial plantings at the Citrus and Subtropical Fruit Research Institute. The three commercial cultivars recommended at present are Fuerte, Edranol and Hass.

Fertilising

During the year under review 250 leaf samples and 171 soil samples were received from avocado producers. Fertilising recommendations, based on soil and leaf analyses, are now being made for roughly 45 per cent of the avocado trees



The three commercial avocado cultivars now recommended

in the Republic that are 5 years old or more.

In many cases the results of leaf analysis, especially in the case of orchards from which samples were received for the first time, show high nitrogen values and low zinc and boron values. Very high phosphorus and fairly high calcium values are often obtained in these soils. Many of these soils are fairly acid with high to very high aluminium values.

Fruit fly

The fruit of certain avocado seedlings is extremely susceptible to fruit fly infestation. Avocados received from domestic gardens in Tzaneen, East London and Nelspruit were examined and fruit fly infestation was confirmed. Similar infestations in commercial orchards are unknown, however.

Root rot

Nursery standards for the cultivation of *Phytophthora*-free trees have now been compiled for avocado nurseries. At present only nurseries which meet the necessary requirements are recommended to prospective buyers.

A concerted effort is being made to control root rot caused by *Phytophthora cinnamomi*. Resistant rootstocks do exist and stocks of propagation material are being built up as fast as possible.

Keeping quality

Efforts to find a replacement for the standard cellophane wrapping material continued; a wax covering was investigated. From the results of trials in which sea transportation was simulated it appears that waxes can replace cellophane. Untreated fruit used as a control, fruit packed in the standard manner in cellophane and waxed fruit took 2, 4 and 6 days, respectively, to ripen after "arrival in England".

Certain waxes were too dense, however, and fruit treated with these did not ripen at all.

Fruit treated with waxes has the additional advantage of shining attractively and therefore has a better appearance than unwaxed fruit.

A trial was conducted to investigate the effect of various fungicides on the keeping quality of avocados. The fungicides had no effect on the ripening rate of the fruit, but did have a slight effect on aspects of internal and external quality which were investigated. The most promising of these fungicides were thiabendazole, benomyl, R23979 and tridemorph.

A preparation used to control cold damage in apples was tested for the same purpose with avocados. The results of this investigation show that this preparation is phytotoxic to avocados, however. The fruit treated in this way showed black scorch marks which look just like cold damage on avocados. This preparation also turned all marks caused by mechanical damage black, so that they became more conspicuous.

PINEAPPLES

Herbicides

A large number of herbicides have been tested for the control of the grasses *Panicum* and *Paspalum* spp. Of all the herbicides tested bromacil still proved to be one of the most effective for the control of weeds and grasses in pineapple fields. However, 3 kg of bromacil ↔ 3 kg of diuron appeared to give better weed control than bromacil alone.

Fertilising

Comprehensive fertilising trials with pineapples during the past few years have produced illuminating results. As regards nitrogen fertilising, it was shown plainly that the requirement during the first few months after planting is very low. It is,

however, very important to apply sufficient nitrogen during the five months preceding flower differentiation. By following this practice a considerable saving on the total quantity of nitrogen applied can be effected.

The results of a potassium fertilising trial show clearly that potassium dressings have a considerable effect on production and fruit quality. There is clearly an optimum level of application as regards production, although the sugar and acid content of the fruit showed a linear rise with increased applications.

The potassium trial also showed that dressings before planting and divided applications to the basal leaves are more effective in boosting production than the same quantity of potassium applied as a leaf spray. It was also found that no difference in production or fruit quality is obtained by using potassium chloride, potassium nitrate or potassium sulphate.

In practice, potassium sulphate is virtually always used at present, and a considerable saving could therefore be effected by switching to the cheaper chloride form.

Nematodes

A series of experiments have been carried out on Cayenne pineapple plants in which conventional soil fumigants were compared with dipping of plant material and foliar spraying with the systemic nematocides phenamiphos and oxamyl. The main nematode species involved were *Meloidogyne javanica* and *Helicotylenchus dihystra*.

Preliminary experiments showed that while oxamyl dips reduced nematode attack, they did not prevent the ultimate build-up of *Meloidogyne* during the first 12 months. Subsequent trials showed that combinations of pre-planting fumigant treatments and post-planting foliar sprays were highly effective in suppressing the nematode population over an extended period.

Granular phenamiphos applied as a pre-planting treatment resulted in the best yield increase, in spite of not giving the most effective nematode control.

An oxamyl dip, with no pre-planting fumigation, but followed by monthly foliar spraying with oxamyl during the first year also produced very good nematode control and high yields.

BANANAS

During 1975 planting material of an improved Cavendish strain was released. This strain is taller than the Dwarf Cavendish and falls into the Giant Cavendish in the following respects:

1. It shows very little choke throat.
2. Cigar-end rot is reduced, possibly as a result of better protection of the bunches from direct sunlight.
3. The bunches are large and cylindrical (not tapered as in the Dwarf Cavendish).
4. The bunches are less compact and it is easier to cut the bunches up into hands.



An exceptionally large, healthy hand of the new banana selection grown by the Citrus and Subtropical Fruit Research Institute

5. With the current size regulations, most of the hands fall into the large to extra large category.

6. Not only are the bunches heavier than Dwarf Cavendish but the percentage waste is also less.

The selection was imported from Australia where it is known as Williams Selection. It has been decided to retain this name.

Following requests to the Banana Control Board approximately 5600 bits and spearpoint suckers have been distributed to the various production areas.

Fertilising

A total of 361 leaf and 353 soil samples were analysed for banana producers. This is an increase of 31 per cent and 96 per cent, respectively, on the figures for the previous season. The results show that 51 per cent of the orchards concerned did not

receive sufficient nitrogen, and that 45 per cent received too much phosphorus and 64 per cent too much potassium.

Low calcium and magnesium values in the leaves were found in virtually half of these orchards and are associated throughout with low pH values in the soil. It therefore appears that liming is not receiving enough attention.

Low values of the micro-elements, particularly copper and boron, were found in the leaves.

Diseases and pests

Work on the burrowing nematode *Radopholus similis* has continued on the Departmental experimental farm in Natal. In post-planting nematicide trials, Nemacur (phenamiphos) at 45 kg of active ingredient per ha gave very good nematode control, but yield responses were disappointing. Dipping trials in which DBCP and Vydate (oxamyl) were used at various dosages in order to try to clean up infested planting material were rather unsatisfactory, since no single treatment gave 100 per cent eradication of the nematode.

Tests carried out to determine the vertical distribution of burrowing nematodes revealed that they occur at depths of up to 600 mm, although the greatest numbers are confined to the upper 300 mm in which most roots occur.

Eradication by clean fallow was attempted commercially, keeping lands clean for a period of 9 months. However, replanting of these sites with clean planting material produced new infections in 3 out of 8 cases.

Experimental fallowing was therefore also tested, extending from periods of 9 to 17 months. Even after 17 months, reinfestations occurred, and it is concluded that clean fallowing, even when combined with fumigation, is an unsuccessful method of eradication. Judicious use of long-term rotations using suitable resistant crops therefore appears to be the only feasible method of eradication.

However, it is clear from the fumigation trials that commercial banana production can still be maintained in *Radopholus*-infested areas through the judicious use of soil fumigation, clean planting material and crop rotation.

The permit system introduced by the Department, by which growers are obliged to test all planting material transported from other areas, has been well supported by growers and has been a further safeguard against the spread of this serious banana pest.

Storage studies

The so-called hard core problem was investigated. The techniques developed during the past season for measuring the hardness of bananas accurately were applied successfully this season. It was again clear that this problem occurred only in the hot summer months. During the cool winter months bananas ripen normally.

The loss of mass in bananas during ripening was also investigated. The percentage loss of mass during this period varied from 0,5 per cent to 2,5 per cent, with an average of about 1,3 per cent under the conditions experienced in the Eastern Transvaal Lowveld. Similar fruit which was transported from the Lowveld to the ripening plants in Pretoria and which was ripened there showed a loss of mass of 1,5 per cent during transportation and 2,4 per cent during ripening.

With a view to a possible change in the method of transportation, an investigation of the tolerance of bananas for low temperatures was started. It was found that exposure to 0°C (for up to a maximum of 30 hours in dry conditions) is not noticeably harmful to the fruit. After this the results change drastically, however. After exposure to 0°C for 6 days the fruit has virtually no market value.

It was also found that humid conditions accelerate and aggravate cold damage. The cold damage suffered by the fruit was chiefly of an external nature. Fruit which showed great external cold damage was nevertheless edible.

Trials were conducted to evaluate the efficacy of 2-chloroethyl phosphonic acid as a ripening agent for bananas. These trials were conducted primarily with the small ripener, who does not want to buy expensive ripening rooms, in mind. It was found that this preparation was effective for ripening the fruit. The solution only remained effective for two days, however.

Another ripening trial was conducted to establish the optimum temperature for the ordinary method of ripening fruit. The most attractive and evenest colouring of the bananas was obtained at a temperature of 19°C. Lower temperatures retarded the ripening process unnecessarily, and higher temperatures resulted in a poorer appearance.

MANGOES

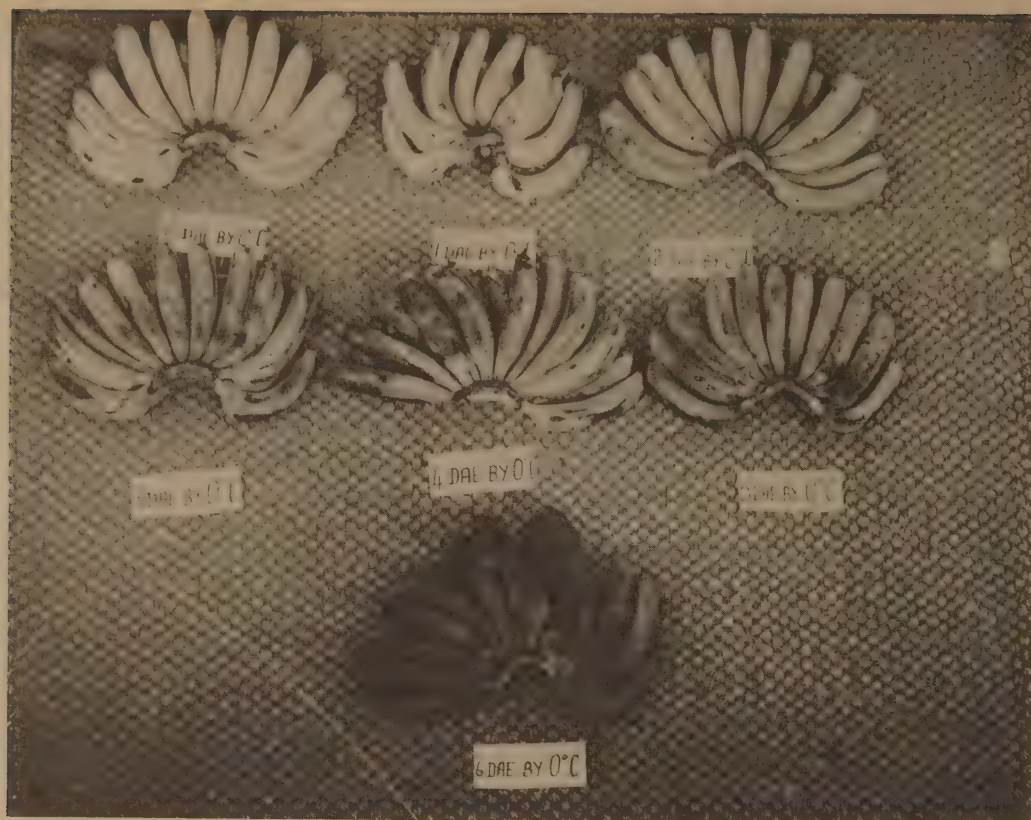
Selections

Work on petal drop, fruit drop and breeding was started during the past year. It was found, *inter alia*, that only 0,5 per cent of the tree's original crop of flowers eventually develops into mature fruit. Methods of improving fruit set by means of hormone treatment and thinning the flowers and fruit are being studied.

Only 4 of the 13 best-known commercial cultivars have shown a fair degree of resistance to mango bacterial spot, viz Peach Zill, Fascell and Sensation. But on the other hand these cultivars have unfavourable properties such as fibrousness, jelly seed, unpredictable crop size and uneven ripening.

Mango cultivation is generally a very disappointing undertaking. Many problems will have to be overcome and techniques will have to be improved before controlled pollination can be successfully applied. Methods of obtaining successful crossings are being investigated.

Mutations are very rare in mangoes. An



Proceeding from top left (0 days) to bottom (6 days), this photograph shows how bananas are affected by cold damage when exposed for different periods to a temperature of 0°C

attempt to create mutations by irradiating polyembryonic seeds was unsuccessful.

Improved cultivars developed in other countries are being imported and tested at the Research Institute at Nelspruit as well as in ideal mango regions.

In South Africa, where until recently, only the local polyembryonic cultivars were planted commercially, there are no seedlings from monoembryonic seeds. At the Research Institute a start has been made with the collection and planting of seed from monoembryonic cultivars so that the seedlings can be evaluated at a later stage with a view to developing improved cultivars. A total of 2 500 selected seedlings have already been established at the Research Institute and at the Messina Experimental Farm.

There are already 81 preliminary selections, many of which will drop out at a later stage when the selection programme is expanded. The preliminary evaluation was based chiefly on internal and external quality, as well as on resistance to mango bacterial spot.

Mango bacterial spot

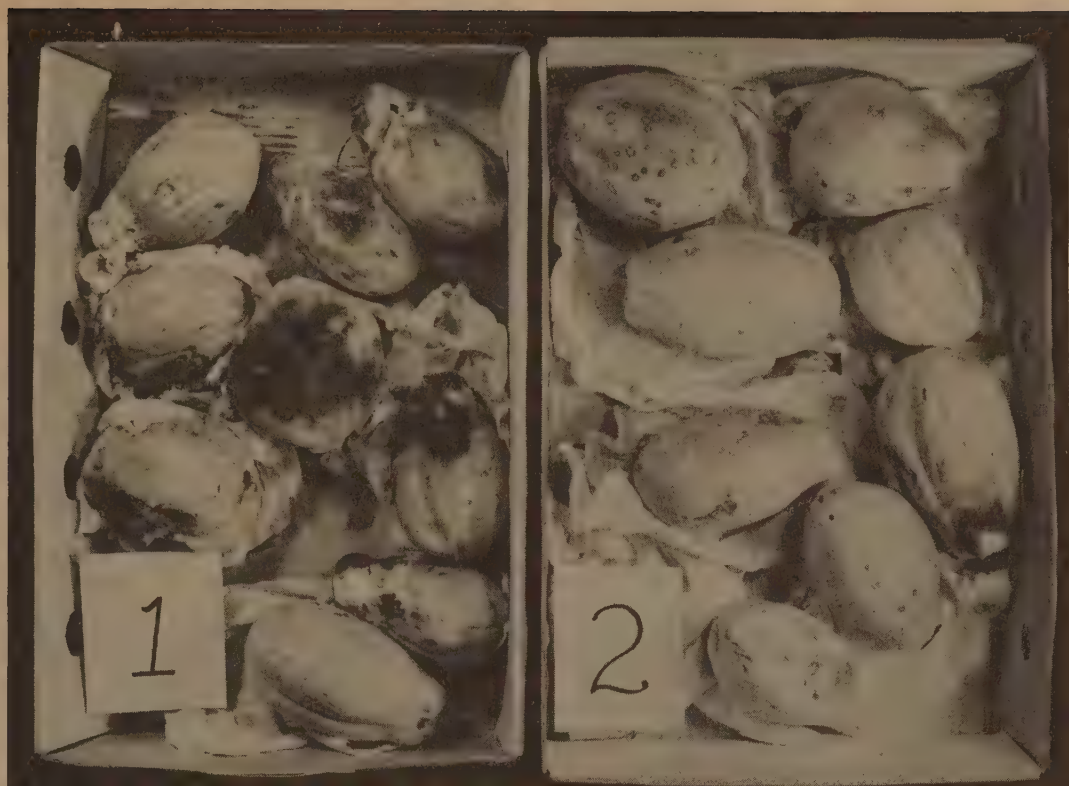
Physiological and biochemical methods have now been found which are reliable in establishing whether or not new cultivars are susceptible to mango bacterial spot infection. The testing of these enzymatic reactions and phenolic acid concentrations will save many years since it can be done on young trees, even before they start bearing.

Post-harvest handling

Several treatments aimed at preventing the post-harvest spoilage of mangoes exported by sea were tested during the past season. These included a hot water treatment followed by a wax coating, a hot water treatment followed by a mixture of wax and fungicide and a hot fungicide treatment followed by various waxes. The results showed that treatment with a hot fungicide solution worked better than treatment with hot water followed by a mixture of wax and fungicide.

However, it was found that fruit immersed in a hot thiabendazole solution showed the least spoilage.

Various wax preparations which were tested gave good results as regards drying out, wrinkling



The effect of warm thiabendazole (no. 2) on the keeping quality of pawpaws that have been stored for 28 days. The fruit in no. 1 was not treated

and discoloration. Where mixtures of wax and fungicide were used, the wax greatly reduced the efficacy of the fungicide, despite the relatively high concentration of fungicide used.

The influence of the picking stage and storage temperature on the keeping quality of Peach, Sabre and Long Green mangoes was tested again. These investigations revealed that Sabre mangoes are not suitable for export owing to their poor keeping quality. It appears that Peach mangoes harvested at a medium colour stage (i.e. when the fruit has just started turning) and stored at a temperature of 7°C look best after a storage period of 31 days. Very little cold damage was observed in this fruit.

It is clear that Long Green mangoes should also be picked at a medium stage of picking ripeness, but stored at 10°C.

PAWPAWS

Pawpaw leaf curl virus (PLCV) seems to have made its appearance in South Africa. Although tests are under way, this virus has not yet been fully identified, but the symptomatology caused by this virus, which is apparently transmissible by grafts and insects closely resembles that of PLCV as encountered in the Far East.

This disease is so closely related to tobacco leaf curl virus (TLCV) that it is surmised that

TLCV and PLCV may be the same virus. PLCV can be transmitted by the white fly *Bemisia tabaci* to tomatoes, pawpaws and tobacco.

Post-harvest handling

Trials aimed at preventing post-harvest spoilage in pawpaws were conducted. The results showed that treating the fruit with a hot fungicide solution (thiabendazole) gave the best protection against the development of spoilage.

The effect of the wax-fungicide combinations on the development of spoilage in fruit was very disappointing. It appears that the wax "seals off" the fungicide, reducing its efficacy. Even in treatments where the fungicide was mixed with the wax at concentrations as high as 16 000 ppm, no significant control of the post-harvest spoilage of pawpaws was obtained.

GRANADILLAS

Various species of granadillas are being tested in an attempt to improve the present yellow species. The grafting of the purple species onto the more tolerant yellow species, which is now being tested, seems very promising so far.

The pathogen of granadilla woodiness disease in South Africa was found to be the passionfruit woodiness virus (PWV) and not the cucumber

mosaic virus (CMV), as was previously thought. PWV is transmitted by an aphid vector or by infected pruning tools.

The host range of this virus was investigated and an ornamental *Passiflora* species was found which is tolerant to the virus. Hybridisation is therefore being attempted to discover whether this phenomenon can be used in the breeding of an acceptable tolerant variety.

GUAVAS

Efforts are still being made to find selections which are suitable for the processing factories, i.e. red-fleshed fruit. At present 25 selections are undergoing stringent testing in order to find the best type for the market.

LITCHI

With regard to the replanting problem, it was found that air-layering with orchard soil constituted a source of eelworm infestation in nursery trees. This practice should therefore be abandoned. Peat moss alone can be used successfully in such cases.

Fumigation of replanting sites with chloropicrin, methyl bromide or dichloropropenes gave an increase of up to 30 per cent in growth during the first 3 years after replanting.

Post-harvest handling

In view of the promising results previously obtained with the control of post-harvest spoilage by means of a hot water treatment, research on this method was continued this season. An attempt was made to establish the best temperature-time combination for this type of hot water treatment for litchis.

The results show that the best possible control is obtained at a temperature of 52°C for 8 minutes. Spoilage was roughly 30 per cent lower in the fruit that received this treatment than in the control fruit, which was untreated. Hot water alone is not effective enough to overcome the problem of post-harvest spoilage in litchis completely.

Another trial was conducted to test the effectiveness of a number of fungicides against this spoilage. The best results were obtained with certain preparations which reduced the incidence of spoilage by nearly 50 per cent, in comparison with the untreated fruit. Combinations of fungicides and the hot water treatment, as well as hot fungicide solutions, were then tested. It is clear from the results that the hot fungicide solutions gave consistently better control of spoilage.

The best control of post-harvest spoilage was obtained with combinations of certain preparations which were applied hot, however. Two combinations reduced the percentage of unmarketable fruit to 5,4 per cent and 5,5 per cent, respectively, as against 85 per cent for the untreated fruit.

Fertilising

A fertilising trial with litchi trees shows that nitrogen fertilising is of the utmost importance as regards production and fruit quality. Nitrogen applications more than quadrupled the yield.

Despite extremely low phosphorus and potassium values in the soil, the application of these two elements caused no improvement in production.

PECAN NUTS

In order to achieve standardisation in the pecan industry and the marketing of pecan nuts it is essential that only the few best cultivars be planted. Desirable, Choctaw, Barton and Wichita are the only cultivars recommended at present for new plantings or the top-working of unproductive cultivars.

1. In areas with a high summer rainfall and humidity, resistance to scab is essential. This includes areas like the Natal coastal belt and interior, the Eastern Transvaal Lowveld and the Soutpansberg-Levubu area, where pecan nuts are cultivated. The cultivars recommended for these areas are Desirable, Choctaw and Barton.

2. Scab is not a serious problem in areas with a summer rainfall of less than 300 mm per annum and low humidity during summer. This includes areas like the Winter Rainfall Region and the far North-Western Transvaal. The cultivars recommended for these regions are Wichita, Desirable and Choctaw.

For purposes of cross-pollination all three cultivars should preferably be planted in both cases.

Fertilising

A fertilising trial with pecan nuts showed that nitrogen dressings increase the yield by up to 50 per cent of the yield from trees that receive no nitrogen. Despite the fact that soil analyses showed very low potassium and phosphorus values in this trial, dressings of these two plant nutrients produced little or no response.

This discovery is substantiated by the results of soil and leaf analyses undertaken for producers. Optimum values are generally found in the leaves, whereas the potassium and phosphorus status of the soils is low in many cases.

MACADAMIA NUTS

Plantings of this type of nut are still expanding. Interest is running particularly high in the Soutpansberg area and a total planting of 1 000 hectares is envisaged.

Processing trials with the first crops from the improved cultivars are at present being undertaken.

A new cultivar, Cate, was imported from California this year.

COFFEE

The coffee plantings at Burgershall and Friedenheim were fairly heavily infested with fruit fly larvae for the first time. Catches revealed that the Natal fruit fly occurs in considerably greater numbers in the Transvaal Lowveld than the Mediterranean fruit fly. This is the case in all the citrus cultivation regions in the country, except the Western Cape.

The fruit fly larvae feed on the pulp of the coffee berry. If the infestation of the berries takes place at an early stage, the pulp is digested completely and only the skin of the berry remains around the two seeds. The skin dries rapidly and is difficult to remove from the seeds. Later this condition hampers the preparation of the coffee for marketing purposes.

TEA

Owing to the labour problems encountered by tea farmers, mechanical harvesting methods were considered as a replacement for hand-picking methods. According to preliminary results, the mechanical method not only saves labour, but also gives a higher gross income per unit area measured.

It appears that mechanical picking yields a 54,6 per cent bigger crop than rough hand-picking and a 93,4 per cent bigger crop than fine hand-picking. Rough hand-picking yields 25,1 per cent more than fine hand-picking.

VEGETABLES

A problem of a serious and lasting nature in the vegetable industry is the shortage of labour, as a result of which some established vegetable producers have switched to other crops that can be more easily mechanically handled. The labour problem is ushering in a new era in the South African vegetable industry. However, if the industry is prepared to make the necessary adjustments in good time the labour problem need not create a crisis situation.

It is possible to mechanise to a far greater extent than is done at present, but total mechanisation is just not possible with many vegetables. There are nevertheless many other ways to mechanise partly if the producers give serious thought to their production processes. The most obvious example, and one which deserves serious attention, is hoeing. Where weeds cannot be chemically controlled the crop rows must be so spaced that a tractor with a mechanical hoe can move between them.

Permanently installed water reticulation systems with standpipes on which the spray heads are mounted make it possible for one labourer to irrigate a very big farm alone and still do a good deal of other work in between. The cost is certainly high, but measured against the rising cost and shortage of labour and the higher prices of vegetables it is undoubtedly justified.

As the labour problem grows, mechanisation will increase until the whole production process has

to be entirely mechanised. Total or nearly total mechanisation is already possible in the case of crops such as green peas, green beans, onions, carrots, beetroot and canning tomatoes.

CANNING TOMATOES

During the year under review canning tomatoes were evaluated for canning quality in collaboration with the National Food Research Institute of the CSIR.

Six samples from the Lowveld (Nelspruit) and 14 from Roodeplaat were offered for evaluation of canning quality. Samples from Nelspruit with a dry matter content of over 5 per cent were Roma VF, Napoli, L1031-8-1-2 and Rossol VFN.

The samples with a ratio of total solids to insolubles of less than 8,0 per cent, which promises a paste of good quality and viscosity, were L1031-8-1-2, Napoli and L1028-1-1-3.

The following samples from Roodeplaat had a dry matter content of more than 5,0 per cent: L1031-3-1, L1144-2, P4023 and P4024. All the other samples except Dorchester had a ratio of total solids to insolubles of less than 8,0.

Breeding strains with exceptional firmness, particularly at the fully ripe stage, were imported from Portugal.

MARKET TOMATOES

A number of strains and cultivars were evaluated at Roodeplaat. The good crop of unblemished fruit from the strains L1102-4-2, L1103-2-1-2 and L1103-3-1, developed in the Lowveld, was particularly worthy of note. The fruit was also very firm. The fruit of the cultivar Florida MH-1 was firm - both at the stage when the fruit begins to change colour and at the fully ripe stage. A characteristic of the cultivar Piersol was the healthy appearance of the leaf growth under the exceptionally unfavourable conditions. The fruit of the cultivar was big and inclined to turn soft.

Spotted wilt virus has occurred to a serious degree in the Winter Rainfall Region during the past few years.

The purpose of the breeding programme at Elsenburg is to develop cultivars for this region that are resistant to the virus disease. A number of selections have been made during recent years which showed no infection, but the fruit quality of these selections is not what it should be.

Of the cultivars evaluated in the winter rainfall area Heinz 1370 and Moneymaker did best and can therefore still be recommended for cultivation. Rooi Kaki did not do well and the cultivar Walter can replace it.

The development of dwarf-type market tomatoes again received attention in the Lowveld. A number of breeding strains were developed, of which L1183 is the most promising. This strain is resistant to nematodes and the fruit is of good quality.



Production trials in winter with various tomato cultivars in fibreglass houses at the Horticultural Research Institute

Cultivation trials

A trial to compare training methods was carried out. Conditions were very unfavourable and as might be expected the percentage of spoilage was greater (14 per cent) in plants lying on ridges than in those that were trained. The cultivar Heinz 1370 with a definite growth habit produced better yields without training than Manapal with an indeterminate growth habit. The greater plant volume of the plants with an indeterminate growth habit evidently helps to create favourable conditions for fruit spoilage and the occurrence of diseases.

An investigation was made into the residual effect of the herbicide Trifluralin, which is used for tomatoes. This was done after complaints were received about the poor results obtained with the herbicide during the summer in the Transvaal Lowveld. No substantial loss of the herbicide occurred in dry soil at 25°C, 45°C and 65°C. The same is true for moist soil kept at 25°C and 45°C.

In damp soil kept at 65°C for 40 days the activity of Trifluralin decreased distinctly in the course of time. The hot, moist conditions experienced in the Lowveld during the summer may

therefore be responsible for the poor results obtained with the herbicide.

Diseases

During the previous season it was found in glasshouse trials that the breeding strain H2990, a canning tomato from the firm Heinz USA, had some resistance to bacterial canker *Corynebacterium michiganense*. It was possible to confirm this observation during the past season. In addition, it was found that the strain L1051-1-2, a market tomato bred by the Horticultural Research Institute in the Lowveld, was also resistant to some extent to the disease.

The investigation into fusarium wilt *Fusarium oxysporum* *F. lycopersici* produced an important result: only strain 1 of this fungus was so far known in South Africa. In the vicinity of Hectorspruit strain 2 also occurred. The race was isolated from the cultivar Rossol. If strain 2 spreads to other tomato producing areas, it may constitute a serious threat.

Only Walter and Florida MH-1 can be recommended for the areas where both strain 1 and strain 2 are encountered.

Glasshouse trials showed that various isolates

of *V. dahliae* from different host plants and from different places vary greatly as regards their virulence towards tomatoes. It appears that the virulence of an isolate cannot always be linked to the host plant from which it was isolated or to the locality where it originates.

The occurrence of bacterial freckle of tomato, caused by *Pseudomonas tomato*, was reported in Natal for the first time. The small dark, raised spots were present on leaves, petioles, stems and fruit. The disease lowered fruit quality and tended to reduce yields, but spraying with a fixed copper fungicide alleviated the condition.

GREEN BEANS

Bacterial blight was again the inhibiting factor in green bean production this year in the summer rainfall region. This disease was encouraged by the heavy rains during the growing season. Cultivars that were previously commonly planted, such as Top Crop, Gallatin 50 and Slenderwhite were so susceptible that they produced virtually no crop. The canning factories, in particular, were hard hit by this disease.

However, it appears that a new cultivar, Thor, which produces pods of exceptional processing quality, has moderate resistance. This resistance in Thor ensures that it produces a reasonable crop, even when conditions are very favourable to the disease.

The breeding strains 265/61-1 and 265/61-3 are resistant to bacterial blight and were submitted to commercial mechanical harvesting trials. Both produced very well and could be mechanically harvested reasonably well.

Another of the Institute's breeding strains which is also resistant to bacterial blight, 1157/4-1, again gave very good results for dehydration purposes.

Pythium wilt, *Pythium* sp., on bean plants nearing the flowering stage was observed this year on beans for the first time in South Africa. This disease was limited to only certain cultivars and breeding strains.

CAULIFLOWER

In a breeding programme to develop early midseason cauliflower cultivar crossings were made between local early breeding strains and Snowcap and Barrier Reef. The aim is to combine good head quality and head cover with earliness.

Results of planting time trials in the Free State show that for plantings from August to February only early and midseason cultivars such as Cumulus, Snowball and Snowdrift can be recommended. For plantings from February to March the late cultivars such as South Pacific, Canberra and Snowcap are recommended.

In cultivar evaluation trials at Roodeplaat Snowball C, Snowcap and White Finish did well. An early cultivar, Snowcrown, also looked very promising. A new midseason cauliflower, Self Blanche, impressed with its good head quality, evenness and exceptionally good head cover. The

well-known midseason cultivars Snowdrift and Snowball also did well again.

The cultivar evaluation in the Lowveld shows that Igloo-Osena, Early Dwarf Erfurt, Snowball, Snowdrift, Canberra and Snowcap are all well adapted.

MUSKMELONS

The Elsche muskmelon is being exported to Europe on a large scale. However, great difficulties have been experienced during recent years with the keeping quality of this cultivar. An investigation in Portugal showed that one of the main reasons for the decline in the quality of Elsche is the poor seed used locally. The Elsche cultivar is not pure and the progeny vary from dark green and almost round to elongated and light green in colour. The light green, elongated fruit usually ripens first and changes colour to yellow in ripening. This elongated light-coloured type of Elsche also has very poor keeping quality and cannot be stored for longer than a week or two.

The dark green, roundish types usually ripen later in the harvesting season. This type is still of a grass green colour when it is ready for harvesting and eating. The dark green type of Elsche is stored in Portugal for three to four months without any loss in quality worth mentioning.

It is clear that Elsche muskmelons can be improved only by special selection in South Africa for more true-to-type strains with good keeping quality.

The Ogen muskmelon is very well adapted in the Western Cape and is exported by air on a large scale. A serious problem with this cultivar is that it has very limited keeping quality and can therefore only be exported by air. In an attempt to develop a comparable muskmelon with better keeping quality Ogen was crossed with Honey Dew. Several promising strains were selected and are now being finally evaluated for keeping quality. These selections are full of promise and may produce a new muskmelon cultivar.

At Barkly West muskmelons destined for export were seriously attacked by anthracnose *Colletotrichum orbiculare*. As far as is known it was the first time that this disease caused such serious damage to muskmelon fruit.

GREEN PEAS

The irrigation requirements of green peas were researched further at Roodeplaat. The reliability of factors in the crop itself in determining the frequency and time of irrigation was compared with the gravimetric method of soil moisture determination.

From the results it appears that the two methods compare very well. In both treatments it was possible to space the 12 irrigations within about three days of each other. This proves that the crop factors for green peas have reached a very acceptable level of reliability at Roodeplaat.

It was also found that 339 mm of water had to be applied over the season for a successful crop.

Of this 339 mm the plants in the treatment according to crop factors used 326 mm as against 300 mm in the treatment by the gravimetric method.

In co-operative trials in the Weenen area the cultivar Venus produced yields slightly higher than those of Mars and considerably better than those of Cape Freezer. The best sowing time in that area seems to be from mid-May to mid-June. From the about 134 selections at Roo-de-plaat 40 strains were selected on the basis of suitability for processing and resistance of the growing plant to frost damage. At the Elsenburg and Outeniqua Experimental Farms the strains that did well as regards adaptability, yield, seed colour and concentrated crop are being evaluated further.

SWEET POTATOES

The big improvement in the yield brought about by virus purified material was stressed again during the year under review. In the Lowveld rogued Brondal and Koedoe cultivars produced 48 and 30 per cent higher yields of marketable sweet potatoes, respectively, than material of the same cultivars grown by producers. At Roo-de-plaat virus purified Impala gave higher yields than any other cultivar. In the Western Province virus-free Koedoe produced a 50 per cent higher yield than the standard cultivar, Borrie.

Promising breeding strains are being tested in various provinces, but at Roo-de-plaat and Glen none was better than Impala and in the Lowveld none was better than Brondal and Koedoe.

Altogether 33 different crossing combinations were made during the past year with the most promising cultivars and breeding strains. Seedling plants will be planted in the coming season for runner multiplication and evaluation.

It was proved again that post-harvest treatment and favourable storage conditions are of supreme importance to the keeping quality of sweet potatoes. Results from preliminary storage trials indicate that Brondal, Borrie, Griekwa, Koedoe and Wildebees kept at 15,6°C for three weeks lose an average of seven per cent in mass, but retain exceptional quality.

Three new sweet potato breeding lines were included in the programme for virus purification. The cultivar Virovsky is being treated further in an attempt to render it virus-free.

The cultivars Kenya and Natal Red now index negative for viruses and can be released to the industry. The following quantities of runners were supplied to nurserymen for multiplication: Brondal 168 000, Impala 39 000, Koedoe 15 000, Eland 11 000, Mafutha 5 000, Borrie 2 000 and Griekwa 2 000. These figures are also an indication of the popularity of the various cultivars with producers.

Results also showed that the aphid *Myzus persicae* can in fact transmit sweet potato viruses, but that it is a slow process. The aphid is therefore a fairly poor vector for the sweet potato viruses.

GEM SQUASHES

A new gem squash cultivar, Rolet, which does not lose its dark green colour after harvesting, was released during the past year. The well-known Little Gem squash has the weak characteristic that there is a colour deterioration from speckled green to yellow within a week of harvesting. The newly released cultivar, Rolet, also does not wilt as quickly as Little Gem.

It will therefore be possible for producers to leave Rolet gem squashes on the plant longer before harvesting and it will also be possible for the greengrocer and consumer to keep them longer without any deterioration in fruit quality.

Testing of control measures against mosaic virus continued. Most success was obtained with a soil cover of aluminium foil. Virus infection set in only after the aluminium foil was completely covered with vegetative growth. As a result a normal crop could be picked from the plants. The control, on the other hand, was so heavily infected with mosaic virus that no marketable fruit could be harvested.

CARROTS

Carrots can be successfully stored for up to two months at a temperature of 0°C. If the relative humidity in the containers is very high (95 per cent), there is a danger that the carrots will crack, but when the humidity is low wilting and desiccation of the carrots occur.

SWEETCORN

For pre-packing the tips of ears of maize are sometimes cut off so that they can be packed in standard containers. When these tips are cut off Rhizopus rot develops fairly rapidly. The use of clean knives is essential and they should be sterilised regularly. Storing sweetcorn at 0°C eliminates the development of Rhizopus.

ASPARAGUS

Cercospora stem spot (*Cercospora asparagi*) on asparagus, which has only once before been identified in South Africa, was found again this year on asparagus in the Pretoria area.

FLOWERS AND ORNAMENTAL PLANTS

PROTEAS

A start has been made on a new series of pamphlets on protea cutting flower farming. It contains new information on intensive methods of production of a wide variety of marketable Proteaceae. The purpose of the series is to put protea farming in the Republic on a sounder scientific basis.

Most proteaceae with commercial possibilities as cutting flowers have already been collected by the Department and are at present being evaluated in test programmes at the Tygerhoek Research

Station. Thirty important pincushion species (*Leucospermum*) from among the 46 natural species were included in a test programme this year. The evaluation of a fairly large number of Proteaceae, with the emphasis on the retention of variety, will last several years.

The most important marketable *Leucospermum* species were tested for propagation from cuttings. It appeared that most good cutting flower species can be easily propagated from cuttings with the help of a mist frame.

It was also found that leucospermums can be readily multiplied by grafting and budding. Alternative methods are therefore available for the true-to-type propagation of leucospermums. Priority will in future be given to making available suitable rootstocks for leucospermums, which should preferably be grafted or budded.

The Division of Plant and Seed Control was appointed international registering authority of Proteaceae cultivars of South African origin by the International Society for Horticultural Science (ISHS). Nurserymen can therefore in future register protea selections with the Division with or without plant breeders' rights and with international recognition. This promises to stimulate the trade in improved breeding material. There is already a demand for selected material. The registration and multiplication of selected material will be given high priority in future.

Protea insect pests are a problem in the industry that is rapidly becoming more serious. Closer attention will in future be given to the control of pests in fresh flowers, seed and plants in plantings.

IMPROVEMENT OF INDIGENOUS BULBOUS PLANTS

Lachenalia

A number of pure species were added to the collection so that there are now 48 species, with a large number of variants, in the gene pool. These species are now being included in the breeding programme.

A few promising selections are being tested for possible release to the commercial flower industry.

Ornithogalum

The *Ornithogalum* breeding programme of the Department of Genetics at the University of Stellenbosch has been taken over by the Horticultural Research Institute. In addition to this material further species which have not previously been used in the breeding programme are being collected for possible inclusion.

Gladiolus

A start has been made with collecting indigenous *Gladiolus* spp. for the purpose of breeding for disease resistance.

Diseases

A leaf spot disease caused by *Pseudomonas* sp. was observed for the first time on chrysanthemums in South Africa.

Four different rose rootstocks, Iowa 66-1, Brooks 56-6, Atwood and Basye-3 were tested in the glasshouse on a limited scale for resistance to *Verticillium dahliae*. Basye-3 was the only one of the four that was resistant and it will now be evaluated for resistance to the disease on a large scale in field conditions.

A large quantity of virus-indexed rose material was again distributed to nurserymen. Included were 98 cultivar trees, 2 200 cultivar buds and 71 000 rootstock shoots.

Chrysanthemums were submitted to virus purification at the request of the flower industry. Eight cultivars were purified of viruses and released to the industry.

Tissue culture trials with leaf parts and pieces of bulbs of certain bulbous plants were successfully completed. This technique of cultivating plants from such small parts is now being used in the process of virus purification of bulbous plants. Experience has already shown that leaf parts produce better results for virus purification because they are usually less infected than the bulb parts.

The following bulbous plants have already been successfully cultivated in this way:

Lachenalia, *Ornithogalum*, *Hippeastrum*, *L. regale*, *L. formosanum*, *Lillium* cv. *Enchantment*, *Cyrtanthus*, *Freesia* and *Dutch Iris*.

POT PLANTS

Pelargoniums

Plants of Regal pelargoniums which did not flower in the spring and early summer owing to too high temperatures were placed in a cold room at 7°C under 100 Watt incandescent lights for six weeks, beginning early in January. They were then placed in a glasshouse at day temperatures of up to 25°C. After three to four weeks they flowered profusely.

Cultivars which responded well to this treatment were Grand Slam, Carnival, Burgundy, Lily Langtry, Black Butterfly, Ella and Jones Distinction. Plants placed under normal office conditions during March and April held their blooms in good condition for three to four weeks.

Regal pelargonium forced into flower during autumn and winter by cold treatment would thus appear very promising as a flowering pot plant for the autumn and winter period in the summer rainfall area. Cuttings taken in February were rooted and given a similar low temperature treatment and flowered in June as attractive single stem plants.

Bougainvilleas

Cuttings taken in March were rooted under mist, potted in April and grown in a glasshouse at a day temperature of 24°C. They were continually topped until flowering commenced in September. Plants treated with Cycocel flowered rather more

profusely than untreated plants. The variety used was Crimson Jewel and this made very attractive pot plants.

When plants were subjected to fluctuating temperatures under normal office conditions some flowers and bracts began dropping after about a week. Spraying with a solution containing a salt of alphanaphthalene acetic acid slowed down the rate of bract drop considerably.

Hypoestes aristata

This plant, known popularly as the ribbon bush, is indigenous to the Eastern Cape and Natal and is now frequently grown as a herbaceous shrub for garden use. It grows about 1 metre high, is tolerant of shade conditions and bears clusters of rose-purple flowers in the axils of the opposite leaves.

Cuttings root very readily and plants can be shaped to the required dimensions for pot plants by treatment with growth regulating substances. Tests have shown that this plant is a typical short day plant and potted plants can be brought into flower in about six to seven weeks by covering with black cloth or plastic to give an effective day length of nine hours.

Flowering potted plants remain attractive under household conditions for four weeks or longer and are tolerant of low light intensities and fluctuating temperatures.

PLANT GROWTH REGULATORS

The height growth of many species of plants can be controlled by treatment with growth regulating substances, thus making it possible to reduce the growth of various shrubs and herbaceous perennials to dimensions suitable for utilisation as flowering pot plants. The green colour of the leaves is also usually improved and the potted plants are often more drought-resistant. Various species, many of which are indigenous to South Africa, have been tested for their reaction to Cycocel and Ancymidol.

It was found that some species react only to one of the growth regulants, some to both, and some not at all. Plants belonging to the Compositae family are especially sensitive to treatment with Ancymidol. Height is satisfactorily reduced by low concentrations applied as a soil drench, and leaf growth is considerably improved.

6. The Livestock Industry

BEEF CATTLE

Utilisation of bull stable facilities, 1974/75

There was a sustained increase in the number of breeders who joined the National Beef Cattle Performance and Progeny Testing Scheme. During the year under review there was a switch to a computer programme which involves more comprehensive data processing.

The number of members who participated in the scheme increased from 890 to 1 092. The number of members per region is indicated in the accompanying table:

Number of members of the National Beef Cattle Performance and Progeny Testing Scheme

Region	1973/74	1974/75	Increase
Transvaal	189	289	100
South-West Africa	187	216	29
Natal	148	171	23
Eastern Cape	135	147	12
North-Western Cape	113	129	16
Free State	103	124	21
Western Cape	15	16	1
Total	890	1 092	202

This increase of 202 members is the biggest to have taken place in a single year since the introduction of the scheme in 1960 and reflects the great interest in performance testing.

The number of herds represented by these 1 092 members is 1 605. The commercial herds are the most strongly represented (813 herds), followed by the Bonsmaras (163 herds), the Simmenthals (149 herds) and the Africanders (133 herds). In all the mass of 155 000 animals was measured.

The bull testing centre at Queenstown was officially handed over to the Minister of Agriculture by the Meat Board during the year under review. This brings the total capacity of all the testing centres to 980. The percentage utilisation of facilities is indicated in the following table.

	Capacity	Accepted	%	Started tests	Percentage of capacity
Irene	410	342	83,4	335	81,7
Armoedsvlakte	220	219	99,5	217	98,6
Queenstown	200	194	97,0	194	97,5
Omatjenne	150	101	67,3	95	63,3
Totaal	980	856	87,3	841	85,8

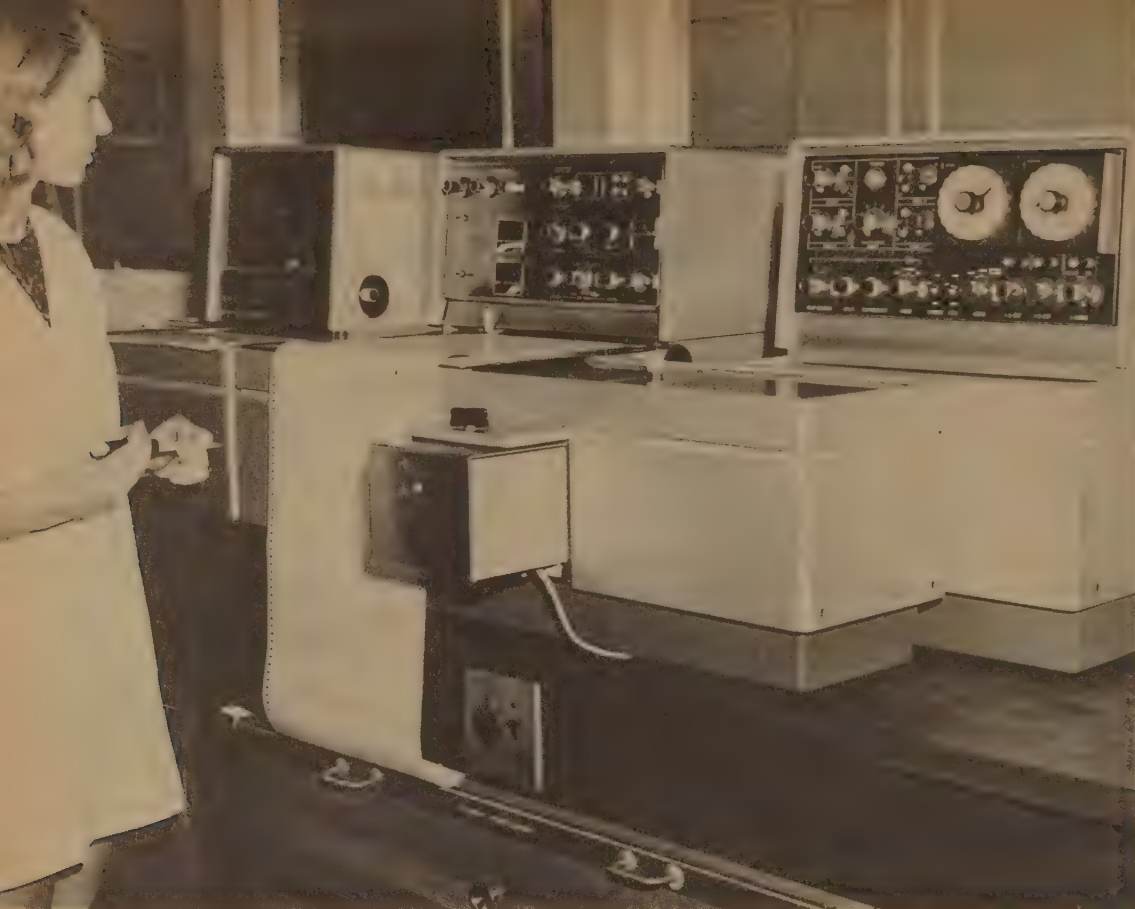
A well-planned investigation of the testing procedure was carried out and certain amendments to the procedure were accepted in principle by the Advisory Committee.

Growth tests on young bulls on the farms of owners enjoyed considerable attention. A total of 1 230 bulls were tested, which is 381 more than the 849 tested the previous year. More bulls are already being tested in this phase of the scheme than in Phase C (central testing centres) The total number of bulls tested during the year was 2 071 - a record.

Meat quality

In South Africa there is very little information available on the meat quality characteristics of the most important beef breeds. In the course of meat production studies at the Animal and Dairy Science Research Institute at Irene the most important indigenous breed, the Africander, and the dairy breed responsible for most of the meat obtained from dairy cattle, the Friesland, were studied under intensive production conditions. After intensive pen feeding bulls and oxen of these two breeds were slaughtered at 8, 12, 16 and 20 months of age in order to determine several meat quality characteristics.

Bull's meat becomes perceptibly tougher than the meat of oxen from the age of 16 months. The solubility of collagen, the main constituent of connective tissue, declines sharply in bulls after this age, and this plays an important part in determining the toughness of the meat. It was also established that the amount of collagen in meat does not increase with age, but that the contribution of collagen to the toughness of the meat of older animals is the result of the decline in solubility that takes place during growth. It was also noted that there is a general increase in the intensity of the colour of meat and that 16 months



In studies of meat quality at the Animal and Dairy Science Research Institute the muscle metabolism of various cattle breeds is studied with the aid of a twin-light-channel spectrophotometer

is again the critical stage; at this age bull's meat becomes noticeably darker than the meat of oxen. From the point of view of meat quality it is therefore clear that it is not desirable to produce meat from bulls over the age of 16 months.

The meat of Friesland oxen between the ages of twelve and twenty months was found to be generally tougher than that of Africander oxen; confirmation for this was provided by the finding that the collagen in the muscles of the Africanders was more soluble than that in the muscles of the Friesland oxen. Although the meat of Africander bulls is considerably darker than that of Friesland bulls, no difference between the muscle colours of the oxen of these two breeds was observed.

Another important quality characteristic of meat is the percentage cooking loss noted when the meat is prepared. Here the Friesland bulls and oxen showed a decided advantage over the Africanders. Of the three characteristics studied, namely tenderness, cooking loss and colour, the first two are of great importance to the housewife.

It was found in the course of an experiment in which the muscle metabolism patterns of the Friesland and Africander breeds were compared that post-mortem changes take place far more

rapidly in the muscles of Africander cattle than in Frieslands.

Intensification of the marketing system of meat, as in the case of pre-packed cuts, means that these quality factors will become increasingly important in the South African meat industry.

One of the aspects of meat quality investigated was the red:white fibre ratio within the muscle. No differences in the percentage of red and white muscle fibres could be shown between the Africander and the Friesland breeds. There were not even any significant differences in the muscle fibre diameters of the two breeds - in the case of either red or white muscle fibres.

In the investigation into the nature and heritability of *laminitis* in Africander cattle the fattening trial with the third progeny group showed that this type of laminitis only appears at a concentrate:roughage ratio of 70:30; at a ratio of 60:40 it is still latent. However, there are indications that once abnormal hoof growth has been induced it cannot be suppressed by switching the animal from a 70:30 concentrate:roughage ration to a 60:40 ration.

Bull calves appear to have a greater tendency to increased hoof growth than heifer calves. In the case of one young bull that developed a serious

case of laminitis during fattening even castration could not retard hoof growth.

Breed comparisons

A large number of bull breeds have been used in a comprehensive programme for evaluating exotic beef breed bulls used with Africander cows. In a study at Vaalharts 838 cross-bred and pure-bred Africander progeny were produced and the evaluation of this progeny has reached an advanced stage. Three hundred and forty-two oxen were slaughtered at the completion of the two trial treatments, viz, fattening for 120 days and slaughtering at about 22 months, compared with an extensive production treatment where the oxen were slaughtered direct from the veld at about 29 months.

The Charolais crosses maintained the best growth, but those included in the late slaughtering treatment could not be sufficiently rounded off to produce a high quality carcase.

The Brahman and Hereford oxen performed equally well under the extensive production system and produced high quality carcasses, but the Brahman showed the worst performance of all the crosses in the feeding pen, whereas the Hereford produced very satisfactory results.

The Simmenthaler fell somewhere between the other breeds in potential. The performance of the pure-bred Africander oxen was considerably lower than that of any of the other crosses in respect of all production characteristics except carcase quality, where they performed as well as the others.

An enormous difference was found between the breeding potential of the pure-bred control (Africander) and the cross-bred animal, especially in respect of early reproduction and production, and re-impregnation during the first lactation: at 18 months 5 per cent of the Africanders showed puberty as against 80 per cent of the cross-bred heifers. Only 28 per cent of the Africander heifers were pregnant at 20 months, as against 88 per cent of the cross-bred heifers.

The re-impregnation of pure Africanders during their first lactation was 74 per cent as against 94 per cent in the case of the cross-bred cows.

Few differences were found between the various cross-bred types, although the Brahman crosses appear to be less fertile after calving at an early age than the Charolais, Hereford and Simmenthaler crosses.

The evaluation programme on European large-framed beef breeds is still in the early stages. Africander progeny from the semen of Blonde d'Aquitaine, Charolais, Chianina and Limousin bulls have recently completed their growth tests under intensive feeding-pen conditions. The most impressive were the Charolais, Chianina and Blonde d'Aquitaine crosses. Under extensive veld conditions the Charolais and Blonde d'Aquitaine heifers grow considerably better than the other two crosses.

The production characteristics of four beef breeds and various beef breed crosses are being investigated at the Mara Research Station.

On very poor grazing the Hereford cows had the highest calving percentage and the Africander cows the lowest of all the pure breeds. Cross-bred cows, which only became available in the later stages of the investigation, maintained a higher calving percentage on reasonable veld than the pure-bred cows. Under very good grazing conditions, such as the conditions that have prevailed during the past few seasons, the pure breeds (with the exception of the Africander) maintain the same high fertility as the crosses.

Major differences within the breeds are found with regard to weaning mass. These differences are magnified as the veld improves. On good veld the Simmenthaler and a three breed rotational cross between Hereford bulls and $\frac{1}{2}$ Africander: $\frac{1}{2}$ Simmenthaler cows performed very well in respect of weaning mass.

On poor grazing there was little difference between breeds and crosses with regard to mass increase after weaning. As the veld improved the performance of the breeds and crosses with a high potential growth vigour improved in relation to that of other breeds. The Simmenthaler in particular showed an excellent mass increase on good grazing.

Feeding

The effectiveness of the various maize silage:concentrate ratios was tested with 18-month old oxen at Potchefstroom by supplying about 80 per cent, 50 per cent and 20 per cent of the dry matter in the form of silage. The highest dry matter content per ox per day was found when about 50 per cent of the dry matter was provided by silage. This decreased again when the concentrate content of the ration was decreased further. Therefore, despite a higher total digestible nutrients content, the ration with a high concentrate content does not produce very much better results with regard to increases and carcase quality than the ration where silage constituted 50 per cent of the dry matter.

Comparative digestibility and production studies were carried out at Potchefstroom with maize silage, stook maize and ripe maize plants. Silage appeared to be the most effective from the point of view of dry matter yields, digestibility, mass increase and carcase mass.

The possibility of getting young oxen ready for the market at an earlier age by means of supplementation while they are receiving veld grazing was investigated at Mara.

Most of a group of cross-bred oxen that were fed a daily ration of 3,44 kg of a mixture of maize meal and urea per ox from weaning age reached super condition at an average age of 18½ months, and an average feed cost of R96.

Another, comparable group where each ox received a daily ration of only 2,31 kg of maize meal and urea mixture took an average of only nine days longer to reach the same stage of



The mass of young bulls is determined at the start of a farm trial

marketability, but the average feed cost was considerably lower, viz R73. Preliminary results of the investigation into the effects of various overwintering levels for heifers in the Eastern Highveld show that:

1. With heifers on a high feeding level ($ADG = 1,0$ kg), covered at a mass of 360 kg at 14 months, the calving percentage of the 1972 heifers was 67 per cent, with a reconception rate of 88 per cent. The conception figure for the following season (1973 heifers) was 92 per cent.

2. Heifers fed at maintenance for two successive overwintering periods and covered at 26 months had a conception figure of 92 per cent at an average mass of 327 kg.

3. Heifers overwintered on submaintenance rations for two successive years and also covered at 26 months had a conception figure of only 67 per cent. This poor result may be ascribed to the low covering mass, which was 286 kg on the average.

At the Athole Research Station weaning masses of 209 and 207 kg at 210 days and 242 kg at 240 days were attained during the past three years; good overwintering practices for breeding cows were applied and the correct stocking rate for the natural grazing was maintained. The conception and reconception figures were 100 per cent and 82 per cent, and 90 per cent and 94 per cent respectively.

An average calving percentage of 91,4 per cent was attained over a 2-year period at the

Dundee Research Station with cows overwintered on maize silage and/or *Eragrostis curvula* hay. A breeding season of only 66 days was used. It appears at this stage that it makes no difference to reproduction whether maize silage or *E. curvula* hay is used as the only source of roughage for overwintering pregnant and lactating cows.

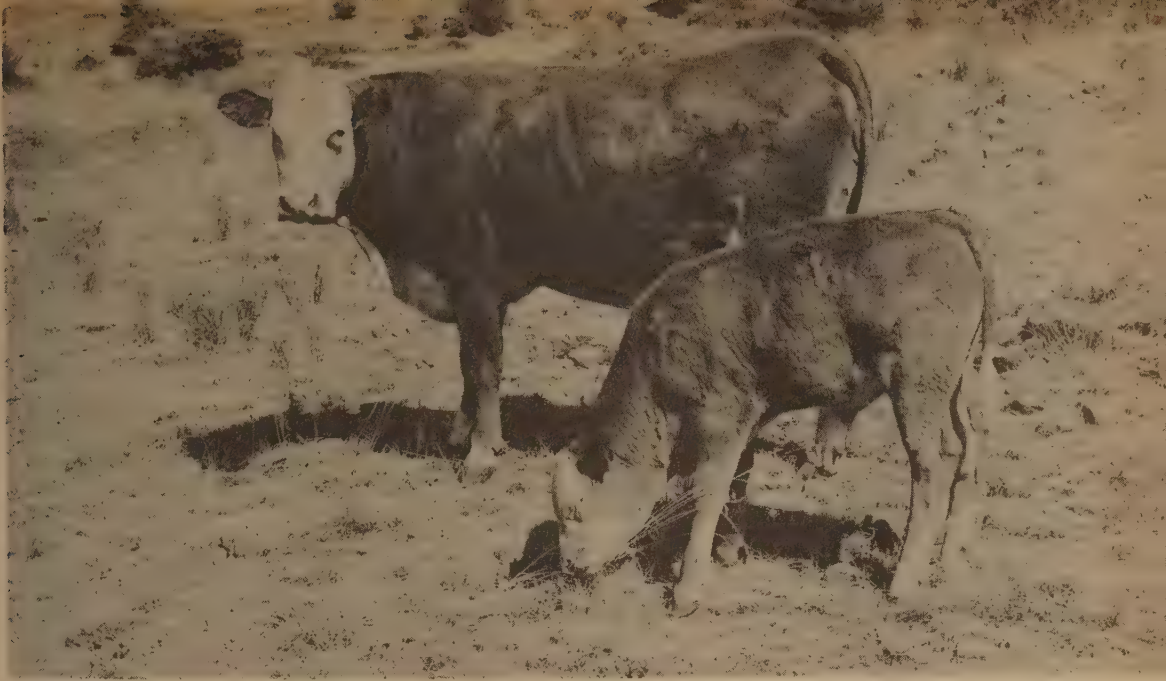
The possibility of finishing beef breed steers on *Eragrostis curvula* grazing and on veld grazing, with or without energy supplementation, was investigated in the Eastern Cape.

The energy was provided in the form of 2 kg of maize meal per head per day. The advantages of *E. curvula* grazing over veld grazing are clear from the increased carrying capacity, greater body mass gain, better grading, higher carcase values and considerably higher gross profit per ha.

The advantage of providing energy supplementation in the form of maize meal, both with *E. curvula* and with veld, was also proved: The body mass gain, carcase mass, grading of carcase value and gross profit per ha were improved considerably. These results were obtained during a season where rainfall was below average.

The possibility of increasing beef production in the sour grassveld area by substituting other types of feed for veld has been shown by these results. Where it is impossible to substitute other feeds for veld grazing, veld grazing can be used for fattening with the correct level of energy supplementation.

In a fattening trial in the Karoo Region with Africander oxen aged about 2,5 years, the provision of additional freshly cut spineless cactus leaves for part of the day resulted in a saving of about 3,0 kg



It has been found that a cow with a sucking calf eats 35 to 55 per cent more than a dry cow

of concentrates per animal per day. This means that 1 kg of concentrates can be replaced by about 6 kg of freshly cut spineless cactus leaves, without the grading of the carcass being adversely affected.

Although the average daily increase in body mass was lower in the groups that received cut spineless cactus leaves, these groups showed a higher dressing percentage. The result is that the average carcass masses of the control group and the group fed on spineless cactus differed very little.

Breeding

The *synchronisation programme* with African cows at Armoedsvlakte was carried out with 150 cows this year. Because of the extreme weather conditions, the incidence of oestrus was lower this year (68 per cent), although impregnation was slightly higher (29 per cent) during the synchronised oestrus. This is still low, but there are indications that various synchronisation procedures will produce more satisfactory results.

Prostaglandin (PGF₂) has been tested in lactating beef cows in an attempt to control oestrus and ovulation. The degree of synchronisation was satisfactory, but the fertility results were discouraging. control oestrus and ovulation. The degree of synchronisation was satisfactory, but the fertility results were discouraging. These poor fertility results were ascribed to the fact that the PGF₂ was administered via the cervix instead of by the recommended intramuscular route.

In a preliminary trial the PGF₂ was administered simultaneously with the semen. The results showed that the fertility of the experimental group was approximately 10 per cent greater than that of the control group, which received no

prostaglandin. PGF₂ increases uterine contractility and this facilitates sperm transport to the site of fertilisation.

A semen quality test which involves giving bulls finishing the tests a semen quality index in addition to the usual performance indices was initiated at the bull testing stations.

An investigation into *early and late weaning* of Africander calves carried out in South-West Africa showed few differences between the two treatments with regard to the growth of the calves and the mass increases of the cows. This indicates that calves can be successfully weaned at 6 months instead of at 8 months.

A study of the effect of the age of first mating on the production characteristics of Simmenthalers was also undertaken. This project is still in the initial stages, but it appears that Simmenthaler heifers reach puberty at an average age of 368 days with an average mass of 267 kg, under veld conditions.

Soutpan

Over 600 persons visited the Soutpan Experimental Farm near Pretoria during the year under review. This figure includes groups of farmers, students, Departmental officers, overseas visitors, scholars and a deputation from the Lebowa Homeland.

DAIRYING

Notwithstanding the very favourable weather conditions throughout the season and the fact that many cream producers switched to the production of milk, milk production fell far short of local requirements. There is every indication that the

Republic is heading for a serious shortage of all dairy products, including fresh milk, but with the possible exception of butter.

Estimates indicate that the total milk production will have to be increased by 40 to 50 per cent to meet the demand for dairy products by 1980. Even during the past year imports of dairy products amounted to 14 to 16 per cent in value of total milk requirements, or about 35 per cent of total industrial milk requirements.

If the total number of dairy cows is put at one million (600 000 for fresh and industrial milk production, and 400 000 cows belonging to cream producers) the average production per cow in milk will have to be 3 000 litres to 3 240 litres per lactation period. The current average production per lactation is 1 500 to 1 800 litres. This figure will therefore have to be doubled to meet the demand by 1980.

Dairy cattle

A comprehensive study on meat production from dairy breeds was undertaken during the past 10 years. The three-year survey conducted among dairy herds involved three-monthly visits to 92 Friesland, 20 Jersey and 31 Brown Swiss herds. The masses of 4 420 dairy calves from which meat was being produced were determined. The calves of Friesland and Brown Swiss cows showed considerably higher mass gains than those of Jersey dams. Friesland and Brown Swiss cows suckled by their dams clearly showed a growth advantage, built up before weaning age and increased and maintained after weaning, over bucket-fed calves. The calves of Jersey cows inseminated with Brown Swiss or Simmenthaler semen, where half the heifers were ovariectomised and half the bull calves castrated, were slaughtered after fattening at an age of 15 months. The bulls showed 18,6 to 35,1 per cent bigger daily mass increases than the other three groups, and an advantage of 13,3 to 16,9 per cent with regard to feed conversion.

Oxen grew faster than heifers and heifers faster than ovariectomised heifers. The fat content of the carcass and the various fat depots was lowest in bulls, higher in oxen, still higher in heifers and highest of all in ovariectomised heifers. Removal of the ovaries had no advantages with regard to production.

Pure-bred and cross-bred Friesland oxen and bulls were compared with Brown Swiss oxen and bulls on a ground snapped corn ration (12 per cent protein) until they reached a live mass of 454 kg. Of the 23 oxen and bulls the Brown Swiss group performed best. Despite the fact that the cross-bred animals were Jersey x Friesland crosses, they performed better than the pure-bred Frieslands, which underlines the value of hybrid vigour.

Cross-breeding with Frieslands resulted in an improvement in production performance and in carcass and meat quality characteristics.

From the time they reached a live mass of 182 kg, 50 Friesland bulls were intensively fed on rations containing 12 and 16 per cent protein, in

order to obtain a clearer indication of the optimum slaughtering stage for bulls. Since the efficiency of feed consumption drops sharply after a live mass of 500 kg has been reached and it is possible to produce prime carcasses with 18 to 19 per cent fat at that mass, 500 kg can be accepted as the optimum slaughtering mass for bulls of the fast-growing lean meat type.

The higher level of protein did result in a higher carcass mass per kg of feed consumption, but the high cost of the animal ration protein made these rations uneconomic.

In trials in which the animals were castrated indications were found that cross-breeding with Frieslands or especially with Jerseys can help to improve meat production from these two dairy breeds. Friesland and Jersey cows were inseminated with Charolais, Brown Swiss, Simmenthaler and Hereford semen. Pure-bred Friesland and Jersey calves were used as a control. Pure-bred animals of the last-mentioned three beef breeds were also included in the trial. Thirteen breed type animals were therefore compared and 163 animals used. All phases of production from insemination to evaluation of the cooked product were studied. The calves were fed intensively. It was found that where Charolais were crossed with Frieslands the cows, especially the heifers, had difficult births. In the latter case up to 50 per cent - which makes this cross a decided risk from the point of view of the condition of the dam and calf at calving. All the crosses performed better than the pure-bred Frieslands. The average age at which the five types reached the slaughtering mass of 454 kg was 16,1 months. The Charolais x Jersey crosses attained the mass of 409 kg at 14,8 months, which indicates that this breed has the potential for a higher slaughtering mass. The three pure breeds were all very efficient in respect of feed conversion, and the Brown Swiss performed the best of all the 13 types in this respect. The carcasses of all five Friesland types were awarded Prime and Super grades. Grading in this mass group was closely linked with the fat content of the carcass. When the quality of the meat of the various types was judged only slight differences were found.

Milk recording

Notwithstanding a big reduction in the number of herds entered for milk recording (a 27 per cent drop) the number of cows tested during the past year increased by 11 per cent. This may be ascribed chiefly to the withdrawal of the small herds. Consequently the average number of cows per herd increased from 31 to 48. 60 000 Completed lactations were recorded, as against 54 000 the previous year. Milk recording is at present carried out for 5,5 per cent of the national herd.

The owner sampling technique was officially introduced during the year under review and is used together with the conventional method by the Milk Recording Co-operative. During the past year the number of cows tested by this method rose from 15 per cent of the herd for which milk

recording is carried out to the present figure of 54 per cent. The technique appears to be very successful: difficult staff problems and financial problems have been largely overcome and it has been possible to improve this service.

The number of milk recording co-operatives has dropped from 13 to 7. 7 147 Heifers were identified under a grade heifer identification scheme. With regard to the testing of young dairy breed bulls, about 5 000 cows were tested in a closed bull testing programme.

Feeding

Various complete rations for dairy cattle, with ground snapped corn as the main ingredient, were tested in the Eastern Cape. The rations containing 65 per cent ground snapped corn gave the best results. The ground snapped corn was supplemented to bring the protein content to about 10 per cent and the fibre content to about 16 per cent. The feed costs per litre of milk amounted to about 4½ cents, despite the fact that all the feed was bought.

It was found in the course of a trial at the Bathurst Research Station that where Jersey cows received maize silage and concentrates separately the feed costs also amounted to about 4½ cents per litre.

Digestibility trials carried out *in vivo* using daily cut kikuyu grass throughout several seasons have shown a considerable variation in the nutritive value of kikuyu grass at different times of the season and at different seasons. The energy values calculated on dry matter of grass varied between 57 and 67 total digestive nutrients and digestible crude protein between 6 and 16 per cent. The total digestible nutrient values obtained in digestibility trials were higher than those estimated from cows performance during the grazing trials.

A system for concentrate supplementation has been developed and computerised in Natal. The computerised service, which produces feeding charts for individual farmers, started in October 1974 and is becoming increasingly popular. IN the first 9 months of service 235 computerised feeding charts have been produced, and 60 Natal farmers have benefited.

The feeding charts specify the amount and type of concentrates necessary for feeding and individual cow, depending on her production and milk butterfat, under specific farm conditions.

In addition to the considerable improvement in the amount of milk produced and the reduction in the cost of purchased concentrates, the service has become an excellent medium for educating farmers in applying better animal husbandry practices.

Management

The Natal Region introduced a copyright computer programme, adopted for Natal conditions during 1974. The programme has been tested on eight dairy herds during the past 9 months.

Although problems have arisen they do not

detract from the overall efficiency of the simulation programme.

The dairy enterprise simulator allows the progressive dairy farmer to assess and budget for his enterprise up to 12 months ahead and therefore provides a powerful planning technique. It is also very useful to the extension officer in planning the fodderflow for a dairy enterprise.

Milk

Quality purchasing of milk

As a result of the Bonsma Report and the recommendations of the Advisory Committee for Dairy Production and Technology, the Animal and Dairy Science Research Institute examined the type and methods of analysis, and the planning of regions and laboratory facilities for the bulk analysis of milk.

The following analyses and sampling techniques are recommended:

Type of milk	Composition	Cleanliness
Milk in cans	Fat and protein (initially 10-day composite samples)	Methylene blue: 3 times a month
Milk in bulk, refrigerated	Fat and protein (3 times a month - single random samples)	Direct bacteria count (above or below a specific standard) There is a prospect
of including other tests; e.g. tests		

Central laboratories with semi-automatic or fully automatic equipment, where provision is made *inter alia*, for fat and protein determinations for the milk recording scheme, are planned. The following table shows the number of samples that will be handled each month for the various areas:

Region	Chemical analyses	Bacteriological analyses
Transvaal	33 055	20 944
OFS	24 261	17 433
Natal	12 496	4 014
N.E. Cape	5 682	2 937
Eastern Cape	9 295	3 141
Western Cape	12 848	6 927
Total	97 637	55 396

To fit in with automation, the apparatus will have to be linked to a data storage unit, a sorting unit and a printing unit. These central laboratories will communicate with factories, field staff, the milk recording scheme and producers.

Protein fractions of individual cows under controlled herd conditions

The interest in the protein composition of milk is based on its importance in human nutrition. The influence of selection on the protein content and composition of milk produced in the Republic will have to be carefully considered in future.

Semen from various bulls is being imported from all over the world and it will be possible to determine what the genetic impact of these bulls is on the protein composition of the milk of their daughters. A complete picture of the protein content and composition of the milk of the herd at Irene is being built up.

The total protein content rises gradually as the lactation period advances, and the percentage of casein drops. The percentages of albumen and other fractions remain fairly constant during the lactation period, although the percentage of albumen starts rising sharply at 7 months.

A further analysis of the results shows that the protein content remains fairly constant during the spring and summer months, after which it rises until it reaches a maximum in winter.

Influence of the physical treatment of milk on lipolysis

On completion of this work it was recommended that pipeline milking machines be installed. This results in a significant reduction in the extent of lipolysis of milk on the farm. This, together with the recommendation that milk be separated after pasteurisation or that cream be continuously pasteurised as it is separated, can result in a spectacular improvement in acid value.

Preservatives in milk

Procedures that will serve as rejection and screening tests were investigated for their suitability (in respect of reliability and sensitivity) for tracing the common preservatives in milk.

Interrelationship between the concentrations of various constituents and the lactose content of mammary gland secretions

The object of this study was to obtain more information on the synthetic activity of the mammary gland and to help answer the question, "What regulates the lactose content of milk". For this purpose some 300 samples of mammary gland secretions obtained from 15 Friesland cows by temporary suspension and resumption of milking were analysed for sodium, potassium, chloride, calcium, magnesium, lactose, total nitrogen, non-casein nitrogen and casein.

No significant correlation was found between casein and lactose content. The relationship between total nitrogen and lactose was not very consistent, but a relatively close relationship existed between each of the following constituents and non-casein nitrogen: sodium, potassium, chloride and lactose.

Methylene blue tests for classifying the quality of refrigerated milk

A study was conducted to find out to what extent the conclusion of the literature that the methylene blue (MB) test is unsuitable for classifying the quality of refrigerated milk is justified. It was shown that when quality categories with 10-fold differences in the total bacterial count were acceptable, 5 to 6 samples of refrigerated milk had to be tested per month as compared with 3 samples in the case of non-refrigerated milk.

Pre-incubation of the samples was shown to be unsuccessful in improving the reliability of the MB test. Therefore, the MB test is more precise for non-refrigerated milk than for refrigerated milk.

Value of various tests for determining the proteolytic bacterial count of milk

The number of proteolytic organisms in raw milk has been used by several authors as an index of hygienic milk production and of potentially harmful effects on the processing and storage quality of milk. Refrigerated milk was tested both for the presence of organisms that could cause milk spoilage and in order to compare the suitability of 3 different media (water agar + 5 per cent skimmilk, Standard Method agar + 5 per cent skimmilk and Standard Methods agar + 1 per cent caseinate) for counting proteolytic bacteria under routine conditions.

To all 3 media an indicator was added to facilitate identification of acid formers.

When counting extensively proteolytic bacteria water agar + 5 per cent skimmilk proved a suitable inexpensive medium. The total count on this medium is, however, lower than that on Standard Methods agar. If the total count needs to be tested at the same time, counting of proteolytic bacteria on Standard Methods agar plus 5 per cent skimmilk (+ indicator) is advisable.

An ecological and taxonomic study of *Streptococcus diacetilactis*

Both the positive and the negative part played by *S. diacetilactis* in the dairy industry are of practical and economic importance. Since the demand for suitable new strains of bacteria for use in starter cultures is increasing all the time, the ecobiology of *S. diacetilactis* was investigated in detail. Results show that the phyllosphere of plants may be a possible source from which to isolate new strains. New isolation techniques should be developed for this purpose.

Over 150 strains of *S. diacetilactis* were isolated from plants, Gouda cheese and cream and classified in accordance with the methods of classical taxonomy.

The incidence of spontaneous variants of *S. diacetilactis* that cannot ferment lactose is of importance where concentrated starters are obtained by continuous culture methods. It was also established that the gene of genes involved in the lactose metabolism are extra-chromosomal.

Non-sterility of sterilised milk

During the latter three months of the year under review 70 sterilised milk samples from four different factories were analysed to determine the non-sterility of this product in South Africa. In order to determine the percentage of unsterile containers, the following tests were done before and after incubation at 30°C for 14 days and 55°C for 7 days: alcohol stability, titratable acidity, odour and taste, plate counts and dilution counts.

Seventy per cent of the samples tested so far have been found to be non-sterile. The most probable number for samples incubated at 55°C was generally higher than counts of samples incubated at 30°C.

Butter

Colour of butter

The colour of edible fats is a decisive criterion of their quality. The first step in introducing a method of measuring and standardising the colour is to provide a numerical description of the colour, because the colour of the samples which are often kept is rarely permanent.

The colour of edible fat products such as butter and margarine is dependent not only on the content of colouring matter (carotenoids), but also on the moisture content and on the manufacturing process.

The relationship between the numerical description of the colour and the B-carotene, moisture and salt content of edible fat emulsions was investigated statistically. The incorporation of moisture decreased the saturation of the colour and increased the lightness of the fat containing a specified B-carotene content per kg of the product (fat + moisture).

The incorporation of gas had a similar effect, and the addition of salt caused a slight reverse effect, i.e. it darkened the colour.

Manufacture of aroma butter

The Dairy Board has accepted the Institute's recommendations for the manufacture of this product and a circular has been sent out to the manufacturers who may be interested in its manufacture. The circular stipulates the quality of the raw product and the equipment which must be available before a manufacturer will be permitted to produce this type of butter.

It has also laid down minimum quality standards with which a manufacturer's normal production must comply before his application will be considered.

Work is continuing on the techniques required to improve the spreadability of aroma butter.

The effect of an increase in the linoleic acid content on the quality of butter and cheese

The linoleic acid of milk fat can be increased by feeding the cows on protected sunflower seed oil, which cannot be hydrogenated in the rumen. If 1 kg of this type of treated oil is included in the

daily ration of cows, the iodine value is raised from 36 to 48, which means that the butter will spread well. In trials with cheese, however, it was found that there is a delay in flavour development. Gas chromatographic analysis showed that such cheese has relatively less of the low fatty acids than the control cheeses, for instance, which accounts for the lack of flavour.

Diacetyl and acetylmethylcarbinol in butter

These two ingredients are the chief flavouring substances in butter and are the most important of the criteria on which the objective determination of the quality of aroma butter is based. The causes of the variation in the results obtained with the diaminobenzidine method have been established and a standard method, which is acceptable for routine analyses and for creameries, has been worked out.

The percentage recoverability for the new method is 92 per cent in the case of diacetyl and 85 per cent in the case of acetylmethylcarbinol.

The determination of copper in milk and butter by means of the graphite tube atom absorption method

The present standard chemical method of determining copper in dairy products is tedious and unsuitable for routine purposes. Since copper is an active catalyst in the oxidation of unsaturated fatty acids and therefore causes some of the major defects in butter, it is important that this contaminant should be avoided.

As a service to dairy factories, the Institute aims to determine the degree of copper contamination by means of atom absorption, with the aid of the graphite tube procedure.

In the case of milk good results are obtained with direct injection. Because the presence of sodium chloride in butter is undesirable a chelating and extraction procedure has to be followed. A better recovery percentage is obtained for both products with atom absorption.

Cheese

The cheese yield and the price of milk

The Froker-Hardin system of payment for milk on the basis of the fat content is based on a rectilinear relationship between the fat content of the milk and the cheese yield. As the fat content increases there is a gradual decrease in the cheese yield per kg of fat, which may be ascribed to the unequal proportions of casein and fat at higher fat levels.

The system of equal remuneration per unit of fat increase (0,1 per cent) is justified only when there is a rectilinear relationship. The following equation may be used in calculating industrial milk prices (it is based on the actual cheese yield values of the milk):

$Y = 472X - 38X - 176,5$ where Y is the price of milk

(1010 c 100 kg 3,5 per cent milk) and X is the % of fat

According to this equation the milk price is directly related to the cheese yield at various fat contents.

The manufacture of low-fat cheese

Experiments were conducted with cheese with a low fat content (25 to 26 per cent fat in dry matter). Cheese with a good body had about 56 per cent moisture in fat-free matter, and cheese containing 63 per cent moisture in fat-free matter was too soft. By modifying the manufacturing process in certain ways the elastic texture characteristic of a low-fat cheese can be prevented.

Certain strains of bacteria of the *Lactobacillus* and *Propionibacterium* genera were added, mainly in order to obtain better flavour development. The development of a bitter taste, which is a characteristic of this type of cheese, is being investigated in order to establish the cause. It was possible to obtain a better texture by using less starter, since too much starter causes a brittle and open texture.

The firmness of film-packed Cheddar cheese

The differences between the composition (fat and moisture) of film-packed cheeses sold after a normal ripening period and that of film-packed mature cheeses were investigated. A survey study, in the course of which random samples from various factories were tested, showed no significant differences in the percentage moisture and the percentage moisture in fat-free matter (an indication of firmness) in film-packed cheeses of various ages, made in various seasons.

Trials at the Institute showed that at a normal ripening temperature and degree of moisture film-packed cheeses sold after a normal ripening period and film-packed mature cheeses show very little loss of mass, and there is no significant difference between the two types.

Neither is there any indication that cheeses intended for long storage (the mature type) are manufactured differently from normal cheeses.

Gas formation by Lactobacilli in film-packed Cheddar cheese

Gas formation below the film in rindless Cheddar cheese was investigated to establish what organisms cause this problem. It was found that heterofermentative (*Betabacterium*) occurred at high concentrations in all the cheeses examined.

Experimental cheeses infected with this organism showed that the heterofermentative lactobacilli are the cause of the problem. As possible solution is to prevent infection during cheese-making and inoculate homofermentative lactobacilli cultures together with the starter cultures.

Ultrafiltration of whey

The cheese industry in South Africa produced (19 000) tons of cheese during 1974. From this production there is a production of 171 000 tons of fluid whey containing approximately 0.8 per cent or 1 368 tons of pure protein of the highest quality.

At present about 72 000 tons of liquid whey is being converted into some 4 300 tons of ordinary whey powder containing 13 per cent protein, that is, 560 tons of pure protein. This protein has a biological value of 95 and a 95 per cent digestibility, which makes it one of the best proteins available for specialised nutrition.

Owing to the very high lactose content of ordinary whey powder, this product is, however, being used mainly for animal nutrition. The balance of approximately 850 tons of protein is either going to waste, resulting in environmental pollution, or being uneconomically for animal nutrition.

During recent years a process known as ultrafiltration has been used to improve the value of the whey powder in several countries by the removal of a certain amount of the lactose to produce a better balanced product. The extent of filtration required to produce various compositions in whey powder for different applications has been studied. The advantage of this process is that it is an extremely simple one requiring only one moving part, namely a pump.

To encourage the local industry to enter into the production of this type of product experimental batches of powder have been made for use in ice cream and for the production of milk replacer for calves. These batches are giving very promising results.

The Department of Health has also shown keen interest in the products as a substitute for skimmed milk powder in its kwashiorkor scheme. As large amount of skimmed milk powder have to be imported annually, the production of these special whey powders could reduce imports appreciably.

Criteria for determining the degree of ripeness of Cheddar cheese

Several criteria for the objective determination of the degree of ripeness of Cheddar cheese, especially mature cheeses, are being tested. Since several factors are involved, the effect of the ripening temperature, the packing method and the fat content were determined on a factor basis.

Study of the propionic acid bacteria in Gouda cheese

It has been suspected for some time that members of the genus *Propionibacterium* may be the cause of late gas development in the preparation of Gouda cheese in South Africa. This study was undertaken to investigate the incidence and distribution of propionibacteria in South African dairy products and collect more information on this genus.

The efficiency of the four prescribed selective media for the isolation and counting of *Propionibacterium* spp. was determined. A semi-selective medium with which better results were obtained was made by adding 0.3 per cent of sodium azide to the yeast lactate medium.

In an attempt to determine what the incidence and distribution of propionibacteria in South African dairy products is, one Gouda cheese and

certain other dairy products from each of the 26 factories in South Africa were examined every three months for a year. It was found that *propionibacteria* do not occur in such great numbers in Gouda cheese as was previously supposed. The organisms were chiefly found in winter and therefore cannot be the cause of the specific defect of Gouda cheese known as late blowing.

Gas openness in South African Gouda Cheese

Starter cultures producing large amounts of carbon dioxide (CO₂) are known to cause defects. Using a new method (the infrared analyser method) a study was made to determine the gas-producing potential of various starter bacteria and also the factors influencing gas production.

It was considered possible that other micro-organisms might be implicated in the appearance of an open texture and gasiness in cheese. It was, therefore, found necessary to test for a number of other micro-organisms including coliforms, propionibacteria, spore formers like *Clostridium* and *Bacillus* species, yeasts and moulds and pediococci.

With the exception of pediococci none of these organisms were found in the defective cheese. By means of the infrared analyser it was shown that pediococci, even in high numbers, did not produce enough gas to form openings in the texture of Gouda cheese.

Gas chromatographic analysis of the volatile fatty acids in the defective cheese after 4 weeks' ripening revealed that the defect was not produced by starter bacteria, coliforms, propionibacteria or butyric acid bacteria. A volatile fatty acid (isocaproic acid) was found in the defective cheese, indicating that the causative organism may be an aerobic spore former.

An aseptic and labour-saving method of handling starter cultures

There is an urgent shortage of trained staff in most cheese factories in the Republic. The facilities at the factories are often inadequate for the inoculation and maintenance of starter cultures. The result is an unnecessarily large number of problems with "slow" starters. A new method, which greatly reduces the chances of contamination of the culture during inoculation and is also labour-saving, was investigated.

The efficiency of certain commercial bacteriophage inhibiting starter media

Two commercially obtainable bacteriophage inhibiting media were tested and compared with reconstituted skimmed milk powder (10 per cent solids) as a culture medium for starter cultures. Three single-strain isolates with their corresponding bacteriophages and one commercial cheese starter were used for the investigation.

The investigation was aimed mainly at determining the activity of the isolates in the various media and investigating the effect of a bacteriophage infection on cell multiplication.

The activity of the cultures in both commercial media was often found to be higher than in the skimmed milk powder. Both commercial media inhibit bacteriophages effectively. The prescribed heat treatment was insufficient to kill all spore-forming bacteria, however.

The preparation and handling of mother and bulk starter cultures in SA cheese factories

Questionnaires were sent to 38 cheese factories in the Republic and South-West Africa in order to gain an idea of the general practice with regard to the preparation and handling of starter cultures in South Africa's cheese factories. Thirty-four factories answered the questionnaire.

The questionnaire covered three main aspects, viz:

1. The handling of mother cultures
2. The handling of bulk cultures
3. General (e.g. problems with bacteriophages)

It is clear from the survey that there is still a great deal of room for improvement with regard to the preparation and handling of starter cultures in cheese factories. "Overripe" starters and poor culture techniques are still frequently found.

Gas-forming bacteria in cheese

In an attempt to isolate and identify the cause of gas openness in 21 Gouda cheeses the following tests were carried out:

pH, salt content, bacterial count, coliform count and gas chromatography.

Bacteria isolated from the cheeses were tested for gas production in milk, and when this was positive the strains were used to make cheese. No organism was isolated which produced identical effects in an experimental cheese to the effects it produced in the cheese from which it was isolated.

A gram positive spore-forming rod which grows aerobically as well as anaerobically was isolated; this rod did produce gas in cheese, but not the same amount of gas as in the original cheese. This bacterium produces gas from milk and several sugars after anaerobic propagation, but ceases to do so after it has been grown for several days aerobically.

Milk Powder

Milk powder flavoured with fruit juices

The addition of artificial flavouring to milk powder is common practice, but the use of powdered fruit juices to flavour milk powder has caused certain difficulties. The coagulation of the casein in the reconstituted product has prevented the addition of fruit juice powders as a flavouring.

Mixtures of milk powder and dehydrated fruit juice can be reconstituted without curdling, provided a suitable stabiliser is added. The stabilising effect on casein seems to be greater when the stabiliser is dissolved in the milk and then dried than when it is dry-mixed with the milk powder.

For practical purposes, however, a dry mixture can be used.

The flavour of the reconstituted product depends very much on the quality of the dehydrated fruit juice. Milk powder containing these stabilisers can be dissolved in natural fruit juice to improve its nutritional value.

The quality improvement laboratory

BUTTER

The quality, on receipt, of 317 butter samples was determined during the past year. The results are reflected in the following table:

Analysis	Class points (percentage incidence)		
	3	2	1
Moisture distribution	20,5	55,2	24,3
Percentage moisture	50,5	31,9	17,6
pH	58,4	19,9	21,7
Percentage salt	35,0	42,7	22,3
Carbonyl value	1,3	36,3	62,4
Acid value	3,2	77,3	19,5
Contaminative organisms	40,0	54,6	5,4
Lipolytic organisms	66,6	26,5	6,9
Proteolytic organisms	48,9	37,2	13,9
Yeasts and moulds	82,0	11,4	6,6
Organoleptic judging (percentage)			
90 points and over		81,7	
Under 90 points		18,3	
Objective judging (percentage)			
85 points and over		31,2	
Under 85 points		68,8	

According to the accompanying table it was only in respect of yeasts and moulds, lipolytic organisms and pH that over 50 per cent of the samples were placed in Class 3. The moisture distribution of only 20,5 per cent of the samples was up to standard. If one takes into account that there is a high correlation between bacterial growth and moisture distribution, creameries should pay more attention to moisture distribution.

It is also possible to control the percentage moisture and salt and it should be easy to bring them into line with the standards. The carbonyl and acid values leave a great deal to be desired. These values indicate the presence of free fatty acids and carbonyl compounds, which cause unpleasant flavours in butter.

According to the present system of organoleptic judging, 81,7 per cent of the butter samples were classified as choice butter. Only 31,2 per cent of the samples complied with the standard set by the Institute.

KEEPING QUALITY

The keeping quality of 287 butter samples was determined during the past year. The results are given in the accompanying table:

Analysis	Class points (percentage incidence)		
	3	2	1
Moisture distribution	34,0	54,4	11,6
Carbonyl value	61,6	24,6	13,8
Acid value	5,2	50,0	44,8
Contaminative organisms	10,8	66,0	23,2
Lipolytic organisms	16,4	52,3	31,3
Proteolytic organisms	51,0	26,9	22,1
Yeasts and moulds	41,5	25,3	33,2
Contaminative organisms - average rise	65,5	18,0	16,5
Acid value - average rise	62,9	25,0	12,1
	35,4	35,7	28,9
Organoleptic judging (percentage)			
90 points and over		66,8	
Under 90 points		33,2	
Objective judging (percentage)			
85 points and over		15,8	
Under 85 points		84,2	

This table shows generally poorer values than the previous table. The carbonyl and acid values were again poor. Only 15,8 per cent of the samples were awarded 85 points or above. When organoleptic judging was carried out 66,8 per cent of samples were awarded 90 points or above. According to the results of the objective judging, therefore, only 15,8 per cent of the samples can be safely stored if necessary.

GENERAL

The factory staff of some factories used to show little interest in the analyses, but interest is gradually increasing now. Most dairy organisations that have control laboratories are very interested in the results. Several of these firms have sent some of their laboratory staff to the Institute to become familiar with the analyses used here.

The analysis of ultra-high temperature milk (UHT milk)

During the past year 134 samples of UHT milk were analysed for the following:

total count
 titratable acid
 pH
 protein stability tests (with 68, 72 and 74 per cent alcohol)

organoleptic grading

The analyses were carried out on receipt of the samples and after incubation periods of 10 days at 30°C and 5 days at 55°C. These incubation temperatures were replaced with a temperature of 35°C at a later stage. This is the only temperature used at present, with an incubation period of 5 days

All the samples analysed proved to have an excellent keeping quality. The samples were all sterile and showed no deterioration after the various incubation periods.

Extension work

The Animal and Dairy Science Research Institute was responsible for the planning of the factory and layout of equipment in the first plant to produce ultra-high temperature (UHT) milk in South Africa. The factory, at Queenstown, came into production in 1974 and has been operating successfully since then.

The Institute was also consulted in the design of two R500 000 factories which are now under construction, viz a milk powder factory at Komga and a cheese factory at Bloemhof.

Fresh milk dairies in South-West Africa have also been assisted with equipment selection and layout.

The Institute assisted in the alterations to and commissioning of a factory manufacturing evaporated goat's milk at Schweizer-Reneke. Protein instability problems were investigated and solved and regular check tests on the quality of the product are being conducted.

Dairy factories were advised on various problems. A great deal of assistance was given to cheese factories in connection with the propagation of starter cultures and problems with bacteriophage contamination. Advice was given on UHT milk and other products such as yoghurt, Camembert and Roquefort cheeses.

SHEEP AND WOOL

The National Mutton Sheep Performance and Progency Testing Scheme

This scheme is showing steady development. During the year under review data from 7 323 lambs were processed, the previous record having been 6 071 lambs in 1973/74.

MUTTON SHEEP

A long-term study with Dorper sheep revealed that mass increase from birth to slaughtering is the biggest single factor that determines the economics of slaughter lamb production. The allocation of points on the basis of the external conformation characteristics of the living lamb, as in the case of phenotypic judging, bore no significant relation to the income from slaughter lambs.

The heritability coefficient for birth and weaning masses was higher for the lambs of young ewes than for those of the older ewes. This means that young ewes can be selected at an early age on the basis of their lambing performance. Ewes that have performed well at an early age are a valuable source of genetic material. If those that show the best growth rate are selected from among their progeny, the genetic improvement of South African mutton sheep could be speeded up considerably.

PERFORMANCE TESTING WITH WOOLED SHEEP

Interest in performance testing, as reflected by the number of wool samples received from breeders, is still increasing. The total number of wool samples analysed remained fairly constant during the previous year, but the samples from research projects dropped from 6 537 to 4 553, whereas the samples from farmers increased from 8 245 to 9 822.

Since its establishment the Fleece Testing Centre has provided an invaluable service to sheep and wool researchers and it is encouraging that woolled sheep breeders are beginning to appreciate the value of this analytical service.

The National Performance Testing Scheme for Woolled Sheep has 72 members at present. This number represents only a very small percentage of the total number of woolled sheep breeders in the country, but when the first members of the scheme start showing the results of applying modern selection practices, the scheme can be expected to start having a far wider impact on the breeding industry.

Three short courses on performance testing were offered and attended by 98 persons. These short courses are the basis of the centre's extension service and expansion programme. Sound co-operation is being received, especially from certain woolled sheep breeders' societies.

PRODUCTION

With the current red meat shortage the importance of maintaining a high breeding rate is receiving more attention than ever before, since meat production is pre-eminently dependent on the number of lambs produced.

The results of the Dorper stud breeding product show that the average lambing percentage (number of live lambs born to the ewes available for mating) could be as high as 147 per cent and that the weaning percentage (number of lambs weaned in respect of the ewes available for mating) could be 143 per cent. According to these figures the post-natal losses would be only 4 per cent.

Research is being undertaken in the Free State Region to determine what the potential is for producing slaughter lambs from the approximately 2 million old Merino ewes culled annually.

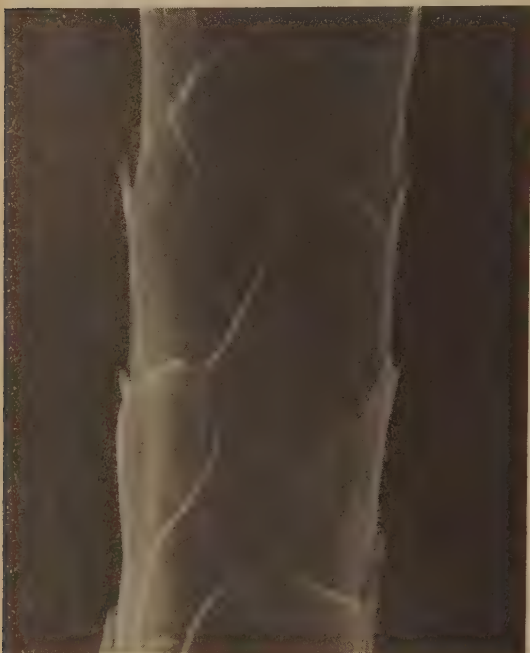
There are indications that a very high lambing percentage (over 150 per cent) can be obtained from old ewes if feeding is maintained at a high level.

BREEDING

Research on the development of a white-wooled mutton sheep for extensive veld conditions was undertaken at the Carnarvon Research Station in the Karoo and has already reached an advanced stage. Results show that the breeding group with the 50 per cent SA Mutton Merino, 25 per cent Merino and 25 per cent Ronderib Africander blood composition did best.



A typical example of the rams used in the Grootfontein Merino stud



This enlargement of 1700 diameters under a scanning electron microscope shows the scale pattern of the wool fibre of a Cheviot sheep

A new breed with this blood composition will therefore be developed.

A two-way selection trial for the properties of wool quality and wool grease in Merino sheep has been in progress in the Karoo Region since 1962; a specific tendency has been developing there during the past few years. A striking degree of correlation between good wool quality and low wool grease on the one hand and poor quality and high wool grease on the other hand has become evident. This is indicative of a negative correlation between wool quality and wool grease. This tendency can be observed in both weaner lambs and two-tooth rams and ewes.

High quality Dormer and SA Mutton Merino rams are made available to the industry by means of an annual stud stock auction at Elsenburg. The Dormer was recently admitted to the SA Stud Book and during the year under review the Department's Dormer stud was recorded in the appendix to the Stud Book, and some Dormers from the Departemental stud obtained full registration.

Cross-breeding with various breeds was investigated in a slaughter lamb trial at the Outeniqua Experimental Farm. The results so far show that the growth rate is about 8 per cent higher in cross-bred lambs than in pure-bred lambs, but the carcass quality is not significantly better than in the case of pure slaughter lamb breeds.

Where Merinos are used as the dams, fairly good quality carcasses are produced by cross-breeding.

In a selection trial at the Tygerhoek Experimental Farm progress through the application of objective selection criteria for wool production is being compared with the performance of a control flock in which no selection is applied. Preliminary results indicate that Merinos can be selected at weaning age for wool production with a fair degree of accuracy.

Lambing performance: comparison of flocks

The integrated breeding programme being followed by the study groups in the Eastern Cape is possibly the first commercial venture which involves the grouping of sheep from different flocks, strains and bloodlines in significant numbers in a common environment. An analysis of the fertility figures for the various families in the nucleus (1975 lambing) serves to stress the effect which different management levels for young ewes from birth to the two-tooth stage may have on their ultimate reproductive performance, even though they have been bred in the same environment. The highest fertility (lambs born/ewes mated) recorded in a family was 120 per cent and the lowest 67 per cent. The multiple birth rates (percentage of pregnancies resulting in twin births) in the same families were 42 and 23 per cent respectively.

Comparisons of this nature, because they are made under identical conditions, are most convincing evidence of the necessity for good nutrition in young ewes from birth to the two-tooth stage.

It is already becoming evident in the second generation that rams selected for use in the central nucleus are a plainer type, showing lighter fronts and fewer skin folds on the body. With the emphasis on size and fertility in the selection programme this tendency is likely to continue to the point where a balance is reached between these properties and wool production.

Short mating period

An analysis of lambing figures for 1974 in the Lowestofte study group in the Eastern Cape has clearly shown that correct management of ewes before and during mating can reduce the mating period to a minimum of two cycles. The resultant shortening of the lambing period not only reduces labour requirements, but also has the advantage of being an effective method of eliminating subfertile ewes from the flock.

The decision to adopt the practice of mating for only 34 days was made after analysis of the 1974 lambing results. Results of the lambing figures revealed that 92 per cent of the ewes lambed within 34 days of the commencement of lambing. The remaining 8 per cent were not, as might be expected, maiden ewes, but mainly older ewes.

Effect of twinning on progeny

Wool and body mass differences between twin and single ewes and rams at the age of 16 months clearly indicate the necessity for identification of all multiple births to avoid discrimination at the two-tooth culling age. Depending on the level of nutrition of such animals from birth to the two-tooth stage, failure to make the necessary adjustments can result in direct selection against multiple births.

It was calculated that the average difference between single and twin ewes at 16 months is 2,3 kg (7,6 per cent) in respect of body mass and 0,553 kg (13,3 per cent) in respect of wool mass. The average difference between single and twin rams of the same age was less marked owing to a higher level of nutrition. However, the 0,5 kg (8,3 per cent) difference in respect of wool mass is sufficiently high to influence selection if no adjustment is made for this factor.

NUTRITION

For the purposes of the Stock Reduction Scheme it is assumed that ewes, irrespective of their production status, are equivalent to one small stock unit (SSU) and that a weaner lamb is equivalent to 0,4 SSU. Controlled studies in which the feed intakes of these classes of animals were compared showed, however, that a ewe with a four-month old lamb is equivalent to 2,2 dry ewes in the case of the SA Mutton Merino and 2,1 dry Merino ewes. The feed intake of the SA Mutton Merino weaner lambs was equivalent to 0,85 per cent of that of the dry ewes of the same breed, and the intake of the Merino weaner lambs to 0,81 per cent of that of the dry Merino ewes. The practical implication of these results is that a lamb weaned at 4 months should be regarded as a full small stock unit. Pregnancy did not cause a significant difference in feed intake.

Experimental results have shown that the optimum protein:energy ratio in growth rations for lambs is determined by the intake of digestible energy. Either an excess of protein or a protein deficiency suppresses the growth rate.

Results also showed that the efficiency of protein utilisation rises with an increase in the intake of digestible energy, but drops as the protein intake rises.

Lactating SA Mutton Merino ewes were wintered on maize silage as the chief source of roughage at Cedara. Urea was added during ensilage or added to the feed at a rate of 0,5 per cent of the mass of the silage. The results as regards lamb growth and ewe mass show that the ensilage of maize with urea is beneficial and that a ration based on maize silage can meet the requirements of highly productive lactating ewes.

The effect of the growth stimulant zeranol on ram and wether lambs was also investigated at Cedara. Four-month old SA Mutton Merino lambs were used. Zeranol was applied at a dosage of 12 mg. In the case of ram lambs no beneficial effect on average daily growth increase, feed conversion,



This group is representative of the 150 two-tooth Merino ewes in the Grootfontein Merino stud. The average wool production of the group is 10 kg.

dressing percentage or grading was observed. Beneficial but not statistically significant effects were observed with wether lambs. The results with regard to meat production were the same for untreated ram lambs and wether lambs treated with Zeranol.

As a result of the rise in ewe numbers in flocks, producers are under increasing pressure to rear lambs under veld conditions, especially in the absence of suitable pastures. In the past supplementation has been used to achieve this object. Improving the quality of the veld is an alternative. With a view to veld improvement sourveld in the Eastern Cape was cut in autumn, or fertilised at a low level of nitrogen (200 kg LAN/ha), or both cut and fertilised. The ewes received only high or low protein licks as a supplement.

Over an 8-week period the growth of the lambs was as follows:

	1973	1975
	g/day	g/day
Veld cut	200	150
Veld fertilised	220	150
Veld fertilised and cut	200	170
Control	210	100

The view that sourveld can only be successfully utilised with the aid of a high protein concentrate has been disproved by research. Adult dry ewes increased in mass and maintained wool production on a relatively low protein lick (14 per cent), but with a high energy supplement to rested sourveld in winter. Generally speaking, better use should be made of this type of lick, especially under sweetveld conditions.

An investigation into the acceptability to sheep of four *Atriplex* species, viz *A. brewerii*, *A. nummularia*, *A. canescens* and *A. lentiformis* produced the following results: The body mass remained constant in all groups. No statistically significant differences in water intake or changes in mass were found among the four groups.

In grazing trial at the Nortier Experimental Farm Dorpers maintained good production with a lambing percentage of 143 per cent and an average carcase mass of 20 kg at 4½ months. Lamb mortality was only 2 per cent and the average meat production per breeding ewe was 25 kg.

It was found at the Outeniqua Experimental Farm that where no supplementation is provided marketing lambs at 5 months produces better results than marketing at 3½ months.

A lamb of the most promising breeding group of the White-wool mutton breed developed at the Carnarvon Research Station. Its combination is 50 per cent South African Mutton Merino, 25 per cent Merino and 25 per cent Roundrib Afrikaner



Karakuls

Research on raising the reproduction rate of Karakuls is in progress in South-West Africa; the emphasis is being placed on hormone treatment and flushing. The results of various covering seasons where flushing was used showed that where grazing conditions are favourable flushing does not play a very important part. The influence of flushing can, however, be clearly seen in winter when the grazing deteriorates. The lambing season is also important, in that winter lambs are heavier, have thicker skins and longer hair than summer lambs. However, good grazing management is more important than flushing in raising the lambing percentages.

Hormone treatments could play a big part in the industry. The great value of hormone treatments lies in the fact that they can be used together with artificial insemination. The results indicate that the oestrus response is very good after treatment. The time of the first ovulation after treatment and the ovulation rate can be affected by the dose of hormones administered and the time of administration. Hormone treatment makes artificial insemination very much easier because the use of teasers become unnecessary.

The breeding of black, grey and white Karakuls is receiving special attention in South-West Africa. The black Karakul flock has been established at Neudam, and work on grey and

white Karakuls is being carried out at the Gellap-Ost and Kalahari Research Stations respectively.

Good progress is also being made with the investigation into the value of the white Karakul in a grading-up programme. At the Gellap-Ost Research Station the development of a recessive white Karakul from ordinary black Karakuls with white brushes and/or blazes is being investigated.

Good progress has been made with the dyeing of white SWAKARA without pre-bleaching. An experiment conducted by the Karakul Board has shown that white pelts lend themselves to dyeing very well and that they can take light pastel colours successfully. It was also established that pelts with a good sheen and hair quality are the most suitable for dyeing. There has been a very favourable response to this breakthrough from the trade, and record prices were obtained for white pelts at the July 1975 auction. The prospects for white SWAKARA seem very promising - provided larger numbers can be supplied.

Suitable drying techniques for pelts are being investigated. In the past major problems were experienced with the drying of pelts, especially during the rainy season. A special slaughtering complex, which includes a drying room, was constructed at Neudam. Several projects aimed at improving pelt quality are also in progress. Studies have shown that the Karakul lamb can be successfully weaned at an early age, provided it



The photographs on pages 114 and 115 illustrate the progress made in the course of 21 years at the Gellap-Ost Research Station in the development of a recessive white Karakul







An example of the type of ram used in the Grootfontein Dorper stud

learns to eat creep feed as soon as possible. Weaning age does not appear to affect growth up to the age of six months. Another fact that emerged is that spring lambs grow somewhat better up to six months than autumn lambs, although the latter become sexually active sooner. Feeding has an influence on reconception in ewes and on the number of multiple births.

BREEDING

A project in the Free State Region in which it is possible to measure the annual breeding progress in respect of the most important characters in Karakul lambs, viz curl type, pattern, hair quality and hair length has already reached an advanced stage.

There appears to be a good response to selection for less curl development. Progress of as much as 40 per cent decrease per annum in curl development has been recorded, and 29, 24 and 14 per cent responses in respect of the improvement in the pattern, hair quality and hair length, respectively, have been obtained.

The development of a gold-tipped chocolate brown Karakul has also reached a stage where important tendencies have emerged. Clearly the prevalence of light hair tips is the main factor which determines the economic value of the pelt. Correlations found between the colour components show that the quality of a brown pelt is determined more by the light hair tips than by the intensity of the brown colour.

The fact that prices for brown pelts were lower at the May 1975 auction than at the February 1975 auction may be ascribed to the rather small assortment of brown pelts auctioned. Furriers preferred to buy better quality black pelts, bleach them and colour them brown. A policy of persuading all breeders of brown Karakuls to sell their pelts at the same auction in order to get a better assortment should be considered.

REPRODUCTION

The reproductive adaptability of Romanov Karakul crosses was evaluated to the final stage during the year under review. The following are the most important conclusions arising from the project:

1. As a pure breed the Romanov is very fertile.
2. When the breed is crossed with the Karakul this high fecundity appears to be retained in the first progeny. A second cross in the direction of the Karakul causes a drop of as much as 67 per cent in fecundity, however.
3. All the Romanov crosses evaluated (87,5, 75, 50 and 25 per cent Romanov) showed strongly seasonal sexual activity. No or very little activity occurs from October to December, which reduces the possibility of producing two lambs a year.

MANAGEMENT

Interesting data on the processing of pelts have been collected. In one experiment the flayed pelts were cut lengthwise into two equal halves. One half was washed and pegged in the conventional way and the other half was pegged without pre-washing. This half of the pelt was cleaned with a damp sponge after being removed from the frame.

The following conclusions were reached:

1. The unwashed pelt dried about 13 hours sooner than the washed pelt. The period during which bacterial action could take place was therefore reduced.

2. There was no difference between the two halves in the sheen and degree of cleanness. (This evaluation was carried out by officers of a Karakul co-operative.)

3. Far less labour is required. The pelt is pegged immediately after flaying and does not undergo the washing process first.

4. The washed pelt showed more curl development; there was sometimes a difference of as much as a grade.

5. There was no significant difference in the prices fetched. Half the pelts were sent away for

preparation, after which final conclusions will be drawn.

An investigation into puberty in Karakul ram lambs shows that young rams are physiologically capable of fertilising ewes at the early age of 140 days. However, physiological and histological investigations have shown that the use of young rams is not advisable before 210 days.

GOATS AND MOHAIR

Because of the rising mohair prices Angora goat farming is attracting lively interest at present and is expanding all the time. This expansion appears to be taking place at the expense of Boer goats.

In a study at the Bathurst Research Station researchers tried to utilise the meat potential of the Boer goat better by weaning the kids early (60 days) at a mass of about 15 kg. The kids received conventional fattening rations in an intensive feeding system.

There are indications that 15 kg is a suitable weaning mass. Preliminary data also indicate that the conventional rations used for lambs are also suitable for Boer kids. The growth rate of the Boer kids was again found to be low, despite a relatively high feed intake (4 per cent of body mass).

The lambing percentage and birth mass were also low, which indicates that there are important feeding deficiencies which are responsible for the fact that the meat potential is not being fully utilised.

The growth and feed data were used to compile provisional feeding standards for growing Boer kids with a mass of 15 kg to 35 kg. This information will be made available to the industry.

Four special information days were held in co-operation with the Mohair Control Board and the basic principles of the veld control, the grazing habits of goats and the inclusion of the animal factor with the various types of veld were explained.

The fertilisation results with frozen Boer goat semen exported to France were satisfactory. Further studies on this technique are being continued and experimental inseminations are being carried out in South-West Africa this year in order to test new methods.

There is great interest in improved Boer goats in those parts of the Northern Cape where shrubveld is plentiful. However, the goats are not being given the attention they need, which is why the income from goats is often lower than that from other types of small stock. However, mail-in records this year showed that farmers who managed their goats well made about R8 net income per small stock unit from them, which is about the same as the income from Karakul sheep or Dorpers.

PIGS

Three new pig performance and progeny testing units - at Cedara, Elsenburg and Irene - were opened during the year under review.



These carcasses of 5-month old cross-bred lambs (Dorper and South African Mutton Merino) weigh an average of 22 kg



Goats used in a trial at the Omatjenne Research Station

Pig Recording and Health Scheme

Membership of this scheme dropped considerably. Only 46 breeders are members of the Pig Recording and Health Scheme at present, as against 56 a year ago. The drop in membership is due chiefly to the fact that some of the smaller herds have been sold because of the considerable rises in production costs. Despite the drop in membership the number of litters recorded has increased as a result of a rise in sow numbers.

Boar performance and progeny testing

The initial problems experienced at the testing centres have been solved. Waste from self-feeders has been eliminated by means of a small modification to the feeders.

The accompanying table contains a summary of the average performance of boars at the new testing centres. A hundred and sixty-four boars have already completed the tests since the self-feeders were modified to eliminate waste. The feed conversion figures for these boars may be regarded as accurate - unlike the feed conversion figures for pigs that completed the tests before the self-feeders were modified.

Rations

A study aimed at quantitating the effect of ration protein and energy on the performance of the pregnant gilt was carried out in order to lay down feeding standards for the sow.

The following important conclusions can be drawn from the trial:

1. The mass increase of the gilt during pregnancy is affected by both the quantity of feed she eats and the protein content of the ration. With a daily feed intake of 1 kg the body mass of gilts fed a ration with a protein content of 16 per cent increased 39 per cent more than that of gilts fed a ration with a 12 per cent protein content. This difference decreased as the diet was increased, however. With a daily intake of 2.5 kg the difference in mass increase was only 8.7 per cent in favour of the high protein ration.

2. The size of the litter produced by the sows in the trial was not affected by the treatments applied, although their body mass was affected by both the feeding level and the protein content of the ration.

3. The daily feeding requirements of the pregnant gilt for specific body mass increases were determined. The data indicate that both the protein level of the ration and the covering mass of the gilt have an effect on the quantity of feed required for a specific increase in body mass. The mass of the progeny produced is also affected.

Research aimed at quantitating the variation in quantity and quality of protein-rich materials is being undertaken by the Animal and Dairy Science Research Institute at present. The extent and nature of the variation is an important consideration in the formulation of diets if we are to ensure that the optimum quantities of protein sources are included in human and animal food.

The accompanying table gives an indication of the variation in the protein and lysine content of samples of fish meal and sunflower and lupin seed.

The causes of this variation and the biological availability of the amino acids are being studied at present.

AVERAGE PERFORMANCE OF BOARS

S.A. LANDRACE

Centre	Num- ber	Final age (days)	ADG (g)	FCR (kg)	C+K (mm)	Dis- quali- fied trot- ters %
Cedara -1*	70	145	847	3,14	44	38
Cedara -1*	5	145	888	3,11	40	40
Elsenburg -1	104	147	860	3,06	36	56
Elsenburg -2	28	157	869	3,05	36	57
Irene -1	115	148	828	3,11	44	83
Irene -2	70	146	865	2,82	41	58
A	289	147	844	3,10	41	63
B	103	149	867	2,90	40	57

TOTAL

392

LARGE WHITE

Cedara -1	16	142	884	3,01	43	12
Cedara -2	8	134	966	2,93	43	50
Elsenburg -1	7	149	873	3,01	39	14
Elsenburg -2	5	144	1030	2,78	35	20
Irene -1	74	145	896	2,80	39	51
Irene -2	48	147	905	2,72	37	29
A	97	145	892	2,85	40	42
B	61	145	923	2,75	37	31

TOTAL

158

GRAND TOTAL 550 boars tested

A - Old self-feeders

B - New self-feeders

ADG - Average daily gain

FCR - Feed conversion ratio

Number of progeny groups tested

	SA landrace	Large white
Cedara	1*	33
	2*	-
Elsenburg	1	7
	2	6
Irene	1	31
	2	13
Total	1	71
Total	2	21

1 - Old self-feeders

2 - New self-feeders

Variation in protein and lysine content

Products	% Protein	% Lysine
Fish meal	66,1 - 78,2	4,7 - 5,6
Sunflower seed	20,7 - 26,6	0,9 - 1,4
Lupin seed	29,3 - 42,5	0,8 - 2,1

Artificial insemination

Pig A.I. is being conducted on a few farms using semen obtained from boars on the farm. The results obtained compared favourably as regards both fertility and litter size with those of natural service. A number of lectures and practical demonstrations have been given on the technique at farmers' days in the Transvaal, Natal, the Western Cape, the Free State and the Eastern Cape.

Pig producers interested in A.I. have been trained at the Animal and Dairy Science Research Institute and on farms.

A pig survey to establish the effect of reproduction on profitability was conducted. The results showed that the major reason for culling sows was poor reproductive performance. A *post mortem* examination revealed that the majority of sows culled were physiologically normal in every respect and the conclusion reached was that poor management was responsible for reproductive inefficiency.

The cost of the losses which could be ascribed to poor reproductive performance were found to be as high as R15 000 for a 100 sow unit.

Some of these losses have been eliminated by the introduction of a pregnancy checking device which has been estimated to save the average pig producer with a 100 sow unit up to R3 000.

The use of pregnant mare serum gonadotrophin (PMSG) and human chorionic gonadotrophin (HCG) as a means of inducing puberty in gilts was investigated. The results indicated that this technique could be used to provide a steady supply of gilts for replacement.

POULTRY

CHICKENS

Despite production control and a considerable increase in the domestic consumption of eggs (15 to 20 per cent), surplus production was higher than ever during the past season - 43 814 cases of 30 dozen eggs more than last year. The surplus was exported at a great loss. Owing to a sharp increase in egg production in most overseas countries, prospects for future exports are poor.

The disproportionate increase in production costs is continuing and a major part of the research programme was aimed at acquiring information that would lead to a reduction in production costs.

Results of trials carried out at Irene indicated that laying rations containing lower percentages of fish meal and less total protein (14 per cent) resulted in a higher income after the deduction of feed costs than rations containing more fish meal and more total protein (15, 16 and 17 per cent).

The hens that received the ration containing the most fish meal produced the highest number of eggs per hen, but the ration was considerably more expensive. As a result of this finding trials that could lead to better utilisation of the protein sources used for poultry feeding are being conducted.

It was also shown at the Elsenburg College of Agriculture that a saving on feed costs can be effected by feeding rations with a low protein and lysine content during the growing stage.

In the course of breeding research at the Potchefstroom College of Agriculture strains in which the sex of the chick can be shown at the day-old stage are being developed. The cost of sexing can be considerably reduced in this way. Good progress has been made and during the past year the average production of the hens used as parents was 243,3 eggs per hen for the strain with the Columbia pattern and 233,7 eggs per hen for the Potchefstroom Koekoek.

Good progress is being made with the development of a strain with a low mass which consequently uses far less feed for body maintenance. During the past year hens of this strain produced 249,9 eggs per hen up to an age of 500 days, with an average body mass of 1,6064 kg.

Egg production test

GLEN

The average production of the hens dropped from 70 per cent to 40 per cent in ten days as a result of the incidence of infectious bronchitis during the last part of September 1974. Although production increased gradually after that, it did not reach the normal level again. Despite this drop in production the average was still 228,08 eggs per hen up to the age of 72 weeks.

In future all the hens in the Glen and Irene egg production tests will be inoculated against every conceivable disease. The 1974/76 test at Glen is full and is already in progress.

IRENE

In April 1974 the hens in the test were hit by a serious outbreak of osteomalacia. In view of the effects of this outbreak, the results of the test are not being published.

The test for 1974/76 is not full, but is already in progress. The rules and regulations for the 1975/77 test have been amended to make provision for overseas entries.

For the first time Haugh units which indicated the internal quality of eggs, were determined in both the Glen and the Irene tests. This measure of internal quality is of great value to breeders and sellers of laying hens.

Meat production tests

Two tests were held during the year, one at Glen and one at Irene. At 8 weeks of age the average body masses in the two tests were 1,98 kg and 1,82 kg and the feed conversion figures 2,054 and 2,11 for both sexes. Researchers are considering admitting overseas participants to the broiler tests at Irene.

Broiler production

The broiler industry has continued to make great strides. The chief reasons are the higher red meat prices and the bigger consumer market, especial among the Bantu. It is estimated that 15 per cent more broilers were slaughtered during the year under review than last year. Eighty per cent of these broilers came from a few big producers, and the rest were supplied by a large number of small producers.

The production costs of broilers - like egg production - are still rising, chiefly because of rising feed costs.

The variation in the quality of the individual feed constituents used for mixing rations is a cause for concern. The results of a trial carried out at Irene showed a difference of 2,7 per cent in the average body mass of broilers at 8 weeks where two identical rations were used, but where the fish meal came from two different sources.

TURKEYS

There is a big demand for breeding turkeys, particularly imported birds. However, it is impossible to say at this stage whether this type of turkey, which is intended for intensive conditions, will become popular with farmers. Some of the strains can only be propagated by means of artificial insemination.

A few undertakings rear large numbers of these turkeys intensively and market them whole, as portions, or in the form of processed products. These products are very popular in some parts of the country, especially the Rand, but consumption is still low in comparison with chicken.

During the year under review a large consignment of turkey and broiler parent strains were imported by private bodies. The 15 per cent of these imports that goes to the Department is multiplied and, together with the material previously imported, made available to interested persons for breeding purposes. During the year

under review 4024 dozen breeding eggs from the broiler strains and 512 dozen breeding eggs from turkey strains were supplied to dealers.

DUCKS

Ducks are kept on a commercial scale by only a few producers. The fertility and hatchability of duck eggs remain a serious problem. Consequently a trial was undertaken at the Department's waterfowl unit at Cedara to test the effect of higher levels of vitamin A, vitamin E and choline in the rations of breeding ducks on fertility and hatchability. The hatching results were considerably better, largely because of the supplementation of vitamins A and E.

Trials are also being undertaken to determine the effect of feed restriction on the productivity of ducks, and to try to reduce the fat content of duck carcasses by means of breeding.

GAME

During the year under review game-proof fences were erected on another 12 farms in the Ellisras extension ward. This brings the total in this ward to 47 farms. In the Thabazimbi district 72 farms had game-proof fences by 1973.

Although a number of farmers use game-proof fencing the main purpose is to promote nature conservation and create hunting facilities, and in a lesser degree to harvest for the market. A number of game carcasses from the Northern Transvaal are offered for sale on urban markets, but they come mainly from farmers who harvest game that are running free on their farms. The animals are often wounded apparently during capture, and a number of them die of their wounds within a short time.

The first farmers' day for game farmers was held by the Letaba district agricultural union in the Hanis Merensky Nature Reserve during the year under review. The farmers' day was addressed by officers of the Department, the Parks Board and the Transvaal Provincial Administration.

A Directorate Committee was appointed by the Department to formulate the policy of the Department on game farming. When game was harvested in the course of the game project at the Omatjenne Research Station in 1973 special emphasis was placed on grazers; in 1974 the emphasis fell on browsers. The 40 buck shot included eland, kudu, gemsbok, hartebeest and a duiker. It was calculated that with this production in a 500 ha camp, 8,27 kg of red meat was produced per ha. The production in 1973 was 6,8 kg per ha. This figure is considered very encouraging.

The harvesting of game still presents a problem, since strict regulations have to be complied with. Only head and neck shots are permitted and the animal should be well bled. The intestines should be removed within half an hour and the belly opening closed with small wire clamps. The total shooting losses decreased from 19 per cent last year to 12½ per cent.

In South-West Africa there are now 70 registered game farms and game research will continue to receive considerable attention.

HORSES

The Nooitgedacht pony is arousing increasing interest. At the first annual auction arranged by the breed society for this breed the average prices were R420 for stallions and R268 for mares. The highest price was R520 for a stallion and R420 for a mare.

The Universities of Pretoria and Stellenbosch are also concerned with the parent stud at present. They have each bought four mares and a stallion.

The Percheron stud at the Elsenburg College of Agriculture now has 12 breeding mares and two stallions. Nine foals were born during the year under review. The stallions are made available for covering mares belonging to farmers at a nominal fee.

There has been an improvement in the demand for heavy draught horses and five horses were sold at an average price of R240 at the annual auction.

7. Veterinary Services

INTRODUCTION

During the year under review there were three outbreaks of **foot-and-mouth** disease in the Republic and one in the Eastern Caprivi. In the two outbreaks in the Kruger National Park, strains SAT I and SAT II of the virus were involved. A single outbreak of the disease, for which the SAT I strain was responsible, occurred in 19 cattle in the Barberton district. All movements of animals and animal products were suspended and inspections of cattle in the vicinity of the outbreak were intensified. No cordons were set up because of the topographical position of the farm concerned. Apart from the routine annual inoculation of cattle, sheep and goats in the foot-and-mouth areas near the Kruger National Park, a second inoculation with the ordinary inactivated bivalent SAT I and SAT II vaccine was administered in the areas nearest to the infected farm.

A total of 101 herds previously infected with **bovine tuberculosis** qualified for tuberculosis-free certificates during the year. There are now 428 herds that have become free of the disease since the scheme for the eradication of bovine tuberculosis was initiated in 1969. The progress of the scheme was less satisfactory this year and it is feared that it will be impossible to make much more progress with the present number of veterinarians in the country. The Division of Veterinary Services therefore plans to begin training senior stock inspectors during the coming year to enable them to carry out tuberculin tests.

Sheep scab has become a serious problem in the Republic. Hundred forty-five outbreaks occurred in 36 magisterial districts outside the homelands, and in the latter there were 42 outbreaks in five districts. Speculators and stock sales are largely responsible for the spread of the disease. In one case 14 outbreaks were traced back to one sale. In another a speculator, by selling infected sheep, was responsible for 17 outbreaks. Everything possible is being done by the Division of Veterinary Services to control the condition, but ignorance about the disease, poor co-operation from some of the farmers and a general shortage of inspectorate staff make this very difficult.

There were no cases of **African swine fever** during the year.

Because of the unusually good rainfall, tick-borne diseases such as **redwater** (*babesiosis*) and **gall sickness** (*anaplasmosis*) caused serious problems among cattle. These diseases appeared in areas where they are usually unknown.

Serious outbreaks of **Rift Valley fever**, affecting cattle and sheep, occurred during the year. The disease was recorded throughout the country, but was particularly severe in the Cape Province, the southern Free State and the western parts of the Transvaal.

For the second consecutive year, favourable climatic conditions and excessive rainfall created ideal breeding conditions for insects, particularly mosquitoes. As predicted by the Veterinary Research Institute, outbreaks of Rift Valley fever occurred throughout the summer months and caused tremendous losses through deaths and abortions in both cattle and sheep.

In spite of recommendations to the contrary, many farmers inoculated pregnant ewes with the live Rift Valley fever vaccine as an emergency measure. This not only caused the expected small percentage of abortions, but resulted in malformations in lambs and prolonged pregnancies in ewes - conditions not hitherto associated with the vaccine.

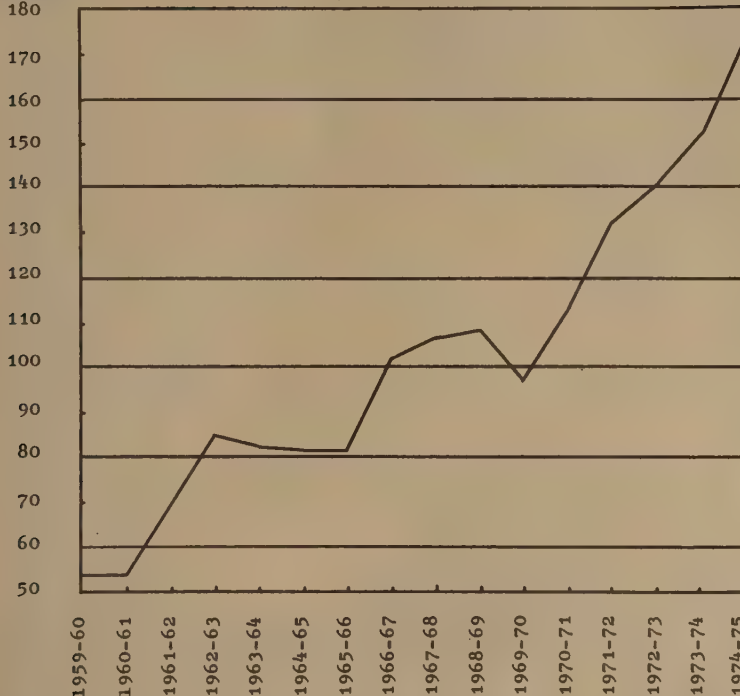
In view of the problems associated with the use of live Rift Valley fever vaccine for pregnant sheep and the poor immunising response obtained in cattle, the Institute developed and produced a safe and effective inactivated Rift Valley fever vaccine in record time. Although the vaccine was initially intended primarily for the immunisation of cattle, it was also used with success for pregnant sheep.

During the year the Institute issued the record number of over 170 million doses of 40 different vaccines. The four new vaccines made available during the year under review represent yet another achievement of great economic importance to the livestock and poultry industries of the country. These are the vaccines against infectious coryza in poultry, and vibriosis and ephemeral fever in cattle, and the Rift Valley fever vaccine mentioned above.

A full-scale investigation into the causes of both pre- and post-natal calf losses was launched during the year. The findings to date have shown that chlamydiosis, (the cause of enzootic abortion in sheep), either alone or in combination with other infections, such as colibacillosis and salmonellosis is the most important cause of calf mortality and retarded growth. Evidence has been obtained that Reovirus, a cause of diarrhoea in calves, is present in South Africa. Chlamydiosis was the commonest cause of abortion in cattle apart from Rift Valley fever, although brucellosis also took its toll. *Coxiella burnetti*, the cause of Q-fever, has been diagnosed in several herds with abortion problems

MILLION
DOSES
MILJOEN
DOSISSE

The demand for Onderstepoort's vaccine is ever increasing. The graph shows the increase in the number of vaccines issued from 1959 to 1975



and is probably a more important cause of perinatal losses than is generally supposed.

Cholera (pasteurellosis) of turkeys was diagnosed for the first time in South Africa and attempts are being made to type the causative organism and develop an effective vaccine. Research is also in progress to determine the causative organisms of foot-rot in cattle and sheep in SA, and to develop suitable control measures.

As a result of the heavy rainfall during the past year, the number of biting insects increased to pest proportions, particularly in the North-Western Cape and Southern Orange Free State, and attempts were made to find a suitable pesticide to control mosquito larvae in the numerous pans. During these investigations, however, a predatory fly, *Lispe barbipes*, was discovered which very effectively controlled mosquito larvae.

Studies on *Parafilaria bovicola*, the cause of false-bruising in cattle, were continued. Therapeutic trials were conducted with eight drugs and promising results were achieved with two. In view of the high dosage levels required, treatment is not an economic proposition as yet.

Redwater is still one of the most important causes of cattle losses in certain areas, and intensive research is being conducted on various aspects of the disease, including its transmission by ticks and its control. A marked improvement in the quality of the redwater vaccine has already been achieved.

The poisoning of animals by toxic fungi is causing increasing concern. During the year an outbreak of an unknown disease which resulted in the death of 130 cattle was investigated in the Northern Transvaal. It was found that a toxic fungus *Aspergillus clavatus* present in the feed was the cause of the deaths. The fungus was isolated in pure culture and it was possible to reproduce the disease experimentally.

The increasing importance of fish as a source of food has necessitated investigations into the diseases of fish. During the year a fatal disease of trout was investigated and found to be due to a bacterial infection which could be controlled by feeding antibiotics.

On 1 July 1974 there were 153 registered research projects at the Institute. A further 15 projects were started and 25 were finalised. A total of 50 scientific articles were published during the year.

NOTIFIABLE DISEASES

Foot-and-mouth disease

During the year there were two outbreaks of the disease in the Kruger National Park and one each in the Barberton district and the Eastern Caprivi. In August 1974 clinical cases of foot-and-mouth disease were found in buffalo in the northern, central and southern regions of the Kruger National Park. From samples, which could only be

taken in the northern areas, the SAT I strain of the virus was isolated from epithelial tissue and the SAT II strain from glandular tissue from specimens taken in the northern areas - the only areas where it was possible to obtain specimens. No cases were found among impala in this area, but the SAT II strain was isolated from them in the central region.

On 19 February 1975 an outbreak of the SAT I strain occurred among cattle in the Barberton district. This was probably due to cattle - game contact. All movements of animals and animal products were suspended and inspection intensified. Cloven-hoofed farm animals, susceptible animals on farms adjoining the Kruger National Park, and those on farms bordering the infected area were inoculated with an inactivated bivalent SAT I and SAT II vaccine. The disease did not spread.

During January 1975 the SAT II strain of the virus was isolated from specimens taken from cattle in the Eastern Caprivi. Thereafter all cattle were inoculated with bivalent inactivated SAT I and SAT II vaccine. Three weeks later fresh cases of foot-and-mouth disease appeared. The SAT II strain was also isolated from these. After this, no further cases were found.

During routine patrols of the Republic's borders 97 cattle, 9 sheep and 154 goats that had been illegally brought into or had strayed into the country were found. Of these, 9 cattle were returned to Rhodesia and 31 goats to Botswana. The rest (total value R11 023) were slaughtered and the carcasses destroyed without compensation.

As a precautionary measure and after the outbreak at Barberton, 206 678 cattle and 63 517 head of small stock were inoculated against foot-and-mouth disease in the stock-farming areas adjoining the Kruger National Park. In November 1974, 44 629 cattle and 954 goats were inoculated in the Eastern Caprivi, and 40 565 cattle were immunised again during the outbreak.

Rabies

Efforts have been made by the Veterinary Research Institute at Onderstepoort to grow the virus contained in one of the two types of rabies vaccine manufactured at Onderstepoort, namely the Flury low egg passage virus, in various types of tissue culture. Satisfactory virus titres were obtained only in hamster foetal cells and in foetal renal cells of the yellow mongoose. Further investigations in this connection are warranted, but research is being hampered by the fact that tissue of the yellow mongoose is not readily available.

Nine-hundred and fifty-eight specimens were tested for rabies during the year; 222 (23 per cent) proved positive. Of the positive specimens, 53 were from SWA, 2 from Swaziland and 1 from Botswana; the remaining 166 were from the Republic of South Africa. The incidence of the disease in various animal species was as follows:

Cattle	67
Yellow mongooses	64
Dogs	35
Jackals	5
Antelope	5

Other wild carnivores
Other farm animals

40
3

The regulations mentioned in the previous report, which were to include the magisterial districts of Thabazimbi, Rustenburg North, Marico and Mafeking 1 and 2 in the proclaimed rabies areas, were promulgated this year. Consequently dogs in these districts will be inoculated against rabies annually as are those in the proclaimed rabies areas of Natal and parts of the Northern and Eastern Transvaal.

The policy of inoculating all dogs and cats within a radius of 15 - 25 km around confirmed cases was again applied. During the year under review 93 712 dogs and 9 189 cats were inoculated in the European areas, and 32 210 dogs and 42 cats in the homelands.

Problems were encountered in placing Phos-texin tablets in meercat holes, especially in the Orange Free State, because of the luxuriant growth of the veld after excessive rains. The only existing rabies unit is still helping with the inoculation of dogs in Gazankulu and Venda.

After inoculating only 111 dogs in the Eastern Caprivi last year, 1 700 were immunised this year and no positive cases have been diagnosed there.

Anthrax

There were seven outbreaks of anthrax in the Republic during the year. Forty-nine cattle and 20 sheep died during these outbreaks. A total of 3 519 840 cattle, 15 805 head of small stock, 65 pigs and 132 horses were inoculated by, or under the supervision of, officers of the Division of Veterinary Services in the European areas; 3 171 963 cattle were inoculated in the homelands.

Three hippopotami died from anthrax in the Kruger National Park.

The attenuated strain of the anthrax bacillus which is used for vaccine production is grown on a solid culture medium. Vaccine production would be greatly facilitated if the vaccine could be grown in large tanks in a liquid culture medium. A small-scale investigation with a medium developed at the Veterinary Research Institute has given satisfactory results. An attempt will now be made to apply this technique to bulk production of the vaccine.

East Coast fever and related diseases

East Coast fever (*Theileria parva*) has not appeared in the Republic since 1954. Smears from animals that die in the scheduled areas are still required. During the year under review 503 428 spleen smears were examined by officers of the Division and the various homelands.

Corridor disease (*T. lawrencei*) appeared in the Eastern Transvaal Region (two outbreaks), Natal (one outbreak) and in kwaZulu (one outbreak). The outbreaks in the Eastern Transvaal were on farms bordering on the Kruger National Park; the other two were on farms adjacent to the Umfolozi



For the diagnosis of rabies it is often necessary to inject mice with brain tissue derived from suspected cases

and or Hluhluwe game reserves. Restrictions on the movement of cattle, intensified dipping and the administering of antibiotics were applied to control the outbreaks.

Benign bovine theileriosis (*T. mutans*) was diagnosed in 75 cases - 61 in kwaZulu and 12 in Venda.

Tuberculosis

A total of 2 287 certificates were issued to tuberculosis-free herds during the year. At the end of this period 3 631 herds were taking part in the tuberculosis eradication scheme, as against 3 589 herds the previous year.

During the financial year ended 31 March 1975, 1 887 positive reactors were slaughtered. The compensation paid to the owners of these cattle amounted to R291 631. Carcases that were not condemned for human consumption were sold for R192 873.

Under the scheme an amount of R253 523 was paid to private veterinarians for tests done and

services rendered on behalf of the State. A further R26 500,00 for INH (isoniazid), which was used in 37 heavily infected herds, and ear tags brings the total outlay in regard to the scheme to R572 252 for the financial year.

There were 293 private veterinarians participating in the scheme at the end of the year under review.

Since the inception of the scheme on 14 May 1969, 428 previously infected herds have qualified for tuberculosis-free certificates.

The scheme cannot progress as desired owing to the shortage of veterinarians, so it has been decided to train certain selected senior stock inspectors to do tuberculin tests. It is intended to offer the first of such courses in the coming year.

The table on the following page is a summary of the tests done during the year.

With the exception of tests on accredited herds, the percentage of reactors was as follows - positive 0,76 per cent, suspected 0,28 per cent.

Pigs are fairly regularly condemned for tuber-

Test	Number of		Reactions	
	herd tests	tuberculin tests	Positive	Suspected
Accreditation	2 779	403 279	-	206
Interim	1 066	119 974	-	340
Diagnostic	420	26 329	-	46
Import	79	827	-	-
Export	169	4 893	-	8
INH	30	9 642	486	92
Infected	425	92 401	1 457	268
Total	4 968	657 345	1 943	960

culosis at abattoirs. In one case in Pietersburg a strain of *Mycobacterium tuberculosis* was isolated as the causal organism. No cases of avian tuberculosis were diagnosed.

Brucellosis

Under the brucellosis eradication scheme 552 809 heifers between the ages of 3 and 11 months were inoculated by or under the supervision of officers of the Division of Veterinary Services and 154 541 such heifers were done in the homelands.

Where the infection was diagnosed and where the State Veterinarian had given written permission for animals older than 11 months to be inoculated, 2 095 females were immunised by, or under the supervision of, officers of the Division of Veterinary Services.

The following serological tests for brucellosis were done at state veterinary offices, regional veterinary laboratories or at the Veterinary Research Institute:

Type of animal	Number of tests	Result	
		Positive	Suspected
Cattle	92 326	7 690(8,3%)	1 867(2,1%)
Small stock	1 758	317(1,8%)	30(1,1%)

The possibility of *Brucella abortus* being transmitted congenitally was investigated at the Veterinary Research Institute in 28 cows which had been artificially infected, 27 of which calved normally. Although seven of the ten heifers and the one bull calf retained for purposes of the experiment were serologically positive for the first three months after birth as a result of the absorption of antibodies via the colostrum, all of them were subsequently serologically negative. To date there has therefore been no indication of congenital or any other form of transmission of the disease to the calves.

Although the artificially infected cows were all serologically positive, *B. abortus* could not be isolated from them or from the bull that served them when the animals were examined after being slaughtered. Subjection of serum specimens from these cows to investigations involving five different serological tests again made it possible to state emphatically that there is as yet no single test by

means of which it is possible to detect infected animals with absolute certainty. The agglutination test proved negative in 0,2 per cent of the cases, the Rose Bengal test in 0,9 per cent, the complement fixation test in 3,86 per cent, the mercapto-ethanol test in 1,3 per cent and the rivanol test in 7,56 per cent; all the other tests showed a positive result.

Trypanosomiasis

(i) NAGANA

No cases of nagana were diagnosed in the Republic.

A few cases did, however, occur in Eastern Caprivi along the Kwando River. The tsetse flies penetrate these areas from Northern Botswana and also from small islands in the Kwando River complex. The number of cases dropped again during the year under review because stock was removed to areas not usually frequented by the tsetse fly.

The annual spraying operations were continued in Mozambique and the Caprivi tsetse fly complex. Because of the favourable results obtained in previous years with spraying in Rhodesia and Mozambique, further spraying was undertaken in an area 130 km east of the Rhodesian - Mozambique border and south of the Rio Save. An area of 661 km² was sprayed from 27 May to 30 September 1974 by four teams using 358 420 litres of 5 per cent wettable DDT powder.

For this operation the Republic provided one senior technician, two officials controlling the transport of the spray teams, six three-ton lorries with drivers, two four-wheel drive vehicles, spares for spray pumps, films for aerial photographs and fuel needed for the making of the access roads. South Africa's financial contribution to the operation amounted to R18 632.

As a result of the operation the tsetse fly threat was again pushed back further from the Republic's borders.

Because of other priorities, Botswana was again unable to contribute to the spraying in the Caprivi tsetse fly complex. Angola was also unable to participate because of political considerations. The Republic was, therefore, solely responsible for the control of the tsetse fly in the complex. The operation, mainly in the Kwando River complex was started on 15 July 1974 and ended on 10 October 1974.

For security reasons, a smaller area than usual was sprayed in Western Caprivi. There were very few tsetse flies found in the areas previously sprayed, which is an indication of the efficacy of the previous year's spraying. In the Caprivi complex an area of about 800 km² was sprayed with 8 000 litres of dieldrin concentrate as a 3,1 per cent emulsion in water. The total cost of the operation was R19 180.

During May 1975 the Interterritorial Committee for Tsetse Fly Control met in Pretoria to plan operations for 1975. Officials of the Republic, Rhodesia, Botswana and South-West Africa attended the meeting.

A stallion with dourine
which shows typical
swelling of the prepuce



(ii) DOURINE

Experiments at the Veterinary Research Institute to demonstrate the parasite *Trypanosoma equiperdum*, which causes dourine, in the cerebro-spinal fluid (CSF) of naturally infected horses showing posterior paresis were successful. This finding has to a large extent clarified the pathogenesis of the disease. A possible correlation between the presence of the parasite in the CSF and the development of the primary nervous lesion - a peripheral polyneuritis - could be postulated on the basis of the drainage of CSF from the leptomeninges.

Provisional research on the chemotherapy of dourine as an alternative method of controlling the disease yielded disappointing results.

During the year 1 603 serum specimens were tested for dourine at Onderstepoort, 56 (3,4 per cent) of which were positive. The distribution of cases, as indicated by the specimens, was as follows: Transvaal 13, Cape 21, Natal 4, OFS 2, SWA 10 and Lesotho 6. The cases in SA and SWA occurred exclusively in horses; only donkeys were affected in Lesotho.

Lumpy skin disease

Although conditions were favourable for the occurrence of the disease, only isolated cases of the Allerton strain were found in the Republic. In Eastern Caprivi 40 per cent of the cattle showed symptoms of the disease. Officials of the Division of Veterinary Services inoculated 45 572 cattle against lumpy skin disease.

Sheep scab

This disease has become a serious problem in the Republic. There were outbreaks in all the veterinary regions as well as in kwaZulu, Lebowa and Bophuthatswana. There were 145 outbreaks in 36 magisterial districts in the White areas and 42 outbreaks in 5 districts in the homelands. The magisterial districts concerned, with the number of outbreaks in each, are as follows: Gordonias (23); Thabamopo (20); Johannesburg (18); Kuruman (15); Ngutu (14); Calvinia (13); Brandfort and Kenhardt (8 each); Lions River and Bloemfontein (7 each); Nkandla (6); Boshof and Paarl (4 each); Tulbagh and Koffiefontein (3 each); Malmesbury, Steynsburg, Mpendle, Umvoti, Babanango, Virginia and Postmasburg (2 each); Williston, Bredasdorp, Frasersburg, Somerset East, Hopetown, Piet Retief,

New Hanover, Pinetown, Dundee, Fauresmith, Kimberley, Christiana, Potchefstroom, Petrusburg, Pietersburg, Waterval Boven, Nebo and Molopo (1 each).

It seems as if speculators and stock sales can usually be held responsible for the spreading of infection. In one case 17 outbreaks on small holdings in the Johannesburg district could be traced back to one speculator, and one stock sale in Natal resulted in 14 outbreaks.

In all 328 739 head of small stock on infected and contact farms were dipped; at least twice in areas outside the homelands, with an 8 to 10 day interval, an approved dip being used under official supervision. Similarly 202 246 head of small stock were dipped in the homelands.

Mange

Sporadic cases of this disease in cattle, pigs and horses occurred in all the regions, especially during the winter months. The condition was severe in goats in kwaZulu and the Transkei. There were 62 outbreaks in the former and 94 in the latter and 144 505 goats in the two homelands were dipped to control the condition.

In all other cases treatment was also successful.

Swine fever

Classical swine fever does not occur in the Republic and no cases of African swine fever occurred.

The results of the survey mentioned in the previous report to determine the incidence of the African swine fever virus by isolating it from the soft tick (tampan) *Ornithodoros moubata* made it necessary to declare the Marico magisterial district a swine fever control area.

There are 636 approved piggeries with 41 931 pigs in White areas within the scheduled swine fever control areas. In the homelands the corresponding figures are 16 and 758.

Swine erysipelas

During the past year there were 33 cases of the disease in White areas, 27 of which occurred in Natal. One case was also diagnosed in Venda.

The morbidity and mortality was low and improved hygiene together with treatment with antibiotics controlled the outbreaks.

Epizootic lymphangitis

No confirmed cases occurred during the year.

Johne's disease

One case occurred in the Transvaal Region. The animal, an imported bull, was destroyed at Onderstepoort and no compensation was paid. As in the past the farm involved and farms on which the disease had previously occurred were closely watched for further developments.

A total of 211 specimens were examined at the Veterinary Research Institute for Johne's dis-

ease. Fourteen of these were positive and 18 were suspect.

Infectious laryngotracheitis

There were 32 outbreaks in the Winter Rain-fall Region, most of which occurred in the Paarl district. The vaccine prepared by the Veterinary Research Institute, together with improved management, effectively brought the disease under control. This vaccine was made available to the public this year. In the past the vaccine was only issued to State veterinarians as an experimental vaccine.

Rinderpest

This disease does not occur in the Republic.

Newcastle disease

Outbreaks again occurred in all the Regions, on small poultry holdings and in backyard flocks where the owners did not adhere to the recommended vaccination programme. There were outbreaks of Newcastle disease in all the homelands with the exception of Qwaqwa and Bophuthatswana. The disease was particularly severe in the Transkei. Officials of the respective veterinary services inoculated poultry where such outbreaks occurred. A total of 107 620 birds were immunised in this way. There were 11 outbreaks among imported birds at the Jan Smuts quarantine station.

Research on the level of immunity obtained after vaccination with different types of vaccine was continued at the Veterinary Research Institute. It was established that two virus types occur in the live Komarov vaccine against Newcastle disease, namely one that forms large plaques in tissue culture, and another that forms small plaques. Both types serve as excellent primary immunological stimuli for high level secondary sensitisation with an inactivated oil-emulsion vaccine (manufactured from the virulent Newcastle disease virus by a firm) which induces an excellent antibody response.

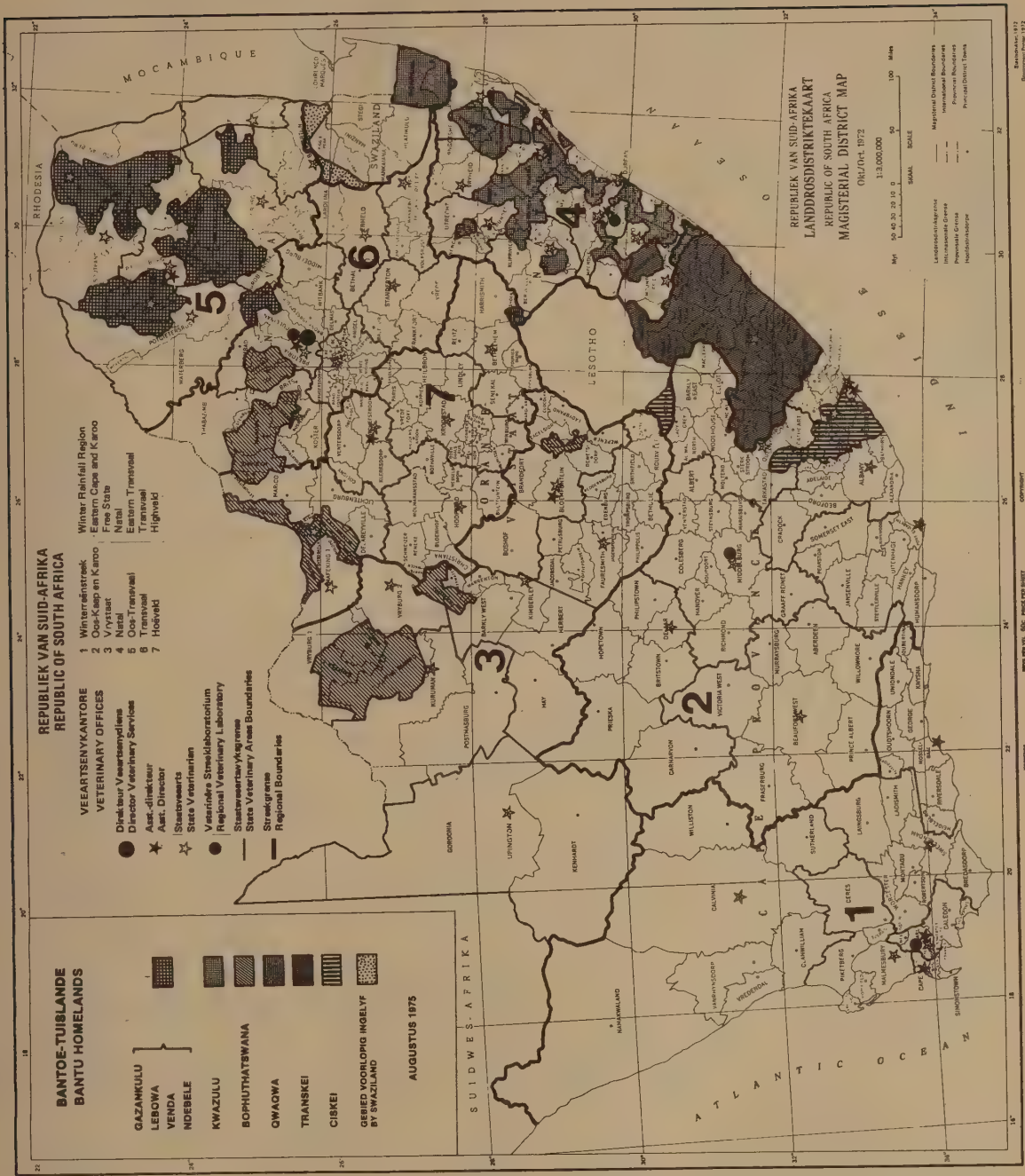
An extensive service is currently being rendered to the poultry industry to ensure that the efficacy of immunisation against Newcastle disease remains as high as possible. The agglutination-inhibition test is being used to determine the antibody level in the yolk of eggs of hens that have been immunised against the disease. This is a practical and cheap method of determining whether the immune response of a flock vaccinated against Newcastle disease is satisfactory.

Bacillary white diarrhoea (BWD) and fowl typhoid

No outbreaks of BWD occurred during the year under review. There were six outbreaks of fowl typhoid of which two occurred in imported birds at the Jan Smuts quarantine station.

Fowl cholera

There were no outbreaks.



BANTOE-TUISLANDE
BANTU HOMELANDS

- GAZANKULU
- LEBOWA
- VENDA
- NDEBELE
- KWAZULU
- BOHUTHATSWANA
- QWAQWA
- TRANSKEI
- CISKEI
- GESEED VOORLOPIG INGELYF BY SWAZILAND

AUGUSTUS 1973

SUIDWES-AFRIKA

REPUBLIEK VAN SUID-AFRIKA
LANDROSDISTRIKTEKAART
REPUBLIC OF SOUTH AFRICA
MAGISTERIAL DISTRICT MAP
08/04.1972

SCALE
0 10 20 30 40 50 60 70 80 90 100 Miles
0 10 20 30 40 50 60 70 80 90 100 Kilometers

- Magisterial District Boundaries
- International Boundaries
- Provincial Boundaries
- Parish District Boundaries
- Landroosdistriktegrense
- Internasionale Grense
- Provinsiale Grense
- Parissdistriktegrense



Psittacosis

There were four outbreaks at the Jan Smuts quarantine station. Despite the standard treatment with antibiotics many of the parrots in the four consignments died, but the disease did not spread to the other cages. There were four outbreaks in Natal and two, one of which was in racing pigeons, in the OFS Region. No other outbreaks were reported.

Scrapie

No cases were reported. Control measures such as regular inspection and permit control of movements from farms are still in force on previously infected farms.

Equine infectious anaemia

No cases occurred.

Glanders

No cases occurred.

Contagious bovine pleuropneumonia

No cases occurred in the Republic.

In Eastern Caprivi 44 629 cattle were inoculated as a precautionary measure.

NON-NOTIFIABLE DISEASES

Bacterial diseases

Mastitis

Dairy farmers again lost thousands of rands as a result of mastitis. Bad management, poor hygiene, lack of personal supervision during milking and the irresponsible use of mastitis remedies are responsible for serious mastitis problems. *Staphylococcus aureus* was isolated as the causal organism in 22 per cent of 2316 specimens in the Winter Rainfall Region.

In the bushveld areas of the Republic udder damage as a result of tick bites gives rise to mastitis problems in beef herds. The homelands in these areas, in particular, are badly affected.

The incidence of blue udder in sheep is increasing. The organisms commonly implicated are *Pasteurella* and *Staphylococcus aureus*. The Onderstepoort *Pasteurella* vaccine is a great help in controlling the condition provided that typing of the causal organism is done, because in the Eastern Cape and Karoo Region a number of cases were found to be caused by strains not included in the vaccine. Good results have been obtained in the Winter Rainfall Region by using experimental vaccines prepared by Onderstepoort from strains of *Staphylococcus aureus* isolated during outbreaks.

Pseudomonas organisms were responsible for 113 cases of mastitis in the Winter Rainfall Region.

It has been established by researchers at the

Veterinary Research Institute at Onderstepoort that the most sensitive method of detecting inflammation of the udder epithelium, i.e. mastitis, is the determination of the concentration of bovine serum-albumin (BSA) in the milk. An immunodiffusion test is used for this. A combination of the BSA technique with conventional methods of diagnosis, namely, cell counts and bacteriological examinations, enables a distinction to be made between true mastitis and other septic and aseptic conditions, such as teat canal infections and non-specific cell reactions, which give a false positive diagnosis.

Some families of dairy cows are known to have more resistance to mastitis than others. Experiments have been carried out on Friesland cattle to ascertain whether there is a correlation between the genes that determine the synthesis of proteins by the udder epithelium and susceptibility to mastitis. The finding is that cows which are heterozygotic for the milk protein-lacto-globulin are significantly less likely to contract mastitis than homozygotic cows. It has further been established that, in comparison with some overseas countries, there are relatively few heterozygotic Friesland cows in South Africa. It would appear that in this country cows are selected for higher milk production rather than high production plus resistance to mastitis, as in overseas countries.

Although only a small number of cultures of *Staphylococcus aureus* was received by Onderstepoort for serotyping, these were from problem herds and flocks, and it is clear that staphylococcal mastitis in cattle and blue udder in sheep remain a serious problem. Attempts are being made to develop a vaccine against these diseases, and promising preliminary results have been obtained with a dead vaccine without an adjuvant.

Enterotoxaemia

Deaths due to pulpy kidney occurred where the farmers had not inoculated or dosed the sheep, or had transferred them to lush green feed before immunity had had time to develop. After complaints from the farmers about problems of administration and reactions at the site of injection of the oil adjuvant vaccine, the old alum-precipitated vaccine was again made available to them. However, with this vaccine, injections have to be repeated more often and the immunity is of shorter duration. A total of 120 634 sheep were inoculated by officers in the homelands.

Black-quarter

Cases occurred in all parts of the country, particularly in the following State veterinary areas: Pretoria, Johannesburg, Rustenburg, Mossel Bay, Pietersburg, Louis Trichardt, Eshowe, Estcourt, Hluhluwe, Ixopo, Kimberley and Queenstown. *Clostridium septicum* and not *Clostridium chauvoei* was the causal organism of cases in the Transvaal, Eastern Transvaal and Eastern Cape and Karoo Regions. *Clostridium oedematiens* caused cases in the Transvaal, Highveld, Natal and OFS Regions.

The inoculation of cattle (between 3 months and 3 years of age) and sheep was made compulsory in the Transkei in order to control the disease. In Lebowa the vaccine is administered free of charge by officers. A total of 147 072 cattle and 111 716 sheep were inoculated by officers in all the homelands.

Botulism (lamsiekte)

Sporadic cases occurred throughout the Republic. Contaminated fodder caused outbreaks in feedlots in the Transvaal Region. In Alexandria cattle died after eating contaminated silage; six cattle died in the Barberton district after chewing the bones of an impala carcass. In Natal cases occurred where fowl manure was fed to cattle in feedlots.

The Onderstepoort vaccine still gives excellent results. There were no outbreaks in the homelands where officers inoculated 4 491 cattle.

Corynebacteriosis

Cases occurred throughout the country. By using hygienic methods during castrations, docking of tails, inoculation, shearing, etc., and by the correct use of the Onderstepoort vaccines, this disease can be effectively controlled. *Corynebacterium* abscesses, as a result of tick bites, occur frequently in the Eastern Transvaal and Natal Regions.

Pasteurellosis

The incidence of this disease is increasing in large parts of the country, chiefly because a more intensive type of farming is being practised. Pasteurellosis caused problems in feedlots in Ermelo and Natal. Rabbit farmers in the Winter Rainfall Region and the Harrismith district also suffered losses as a result of pasteurellosis. *Pasteurella* lung abscesses in young lambs occurred extensively in the Eastern Cape and Karoo Region and in the Western Orange Free State.

This organism also caused cases of blue udder in sheep in the Winter Rainfall, Eastern Cape and Karoo and OFS Regions. In the Eastern Transvaal Region the disease was diagnosed only in sheep. It also occurred in Venda and Bophuthatswana.

In all cases the correct use of the Onderstepoort vaccine has the desired result.

Pasteurella pneumonia is commonly diagnosed at *post-mortem* examination in many species of animals. *P. haemolytica* was isolated at the Veterinary Research Institute from cases in cattle, sheep and a horse, and *P. multocida* was obtained from cattle, sheep, pigs and rabbits. Extensive mortalities in feedlot cattle were in fact ascribed to the latter organism.

Cholera of turkeys was diagnosed for the first time in South Africa by the Veterinary Research Institute at Onderstepoort. Since the disease, which occurs in a chronic form, is of considerable economic importance, methods of serotyping isolates are being developed with the ultimate aim of producing a vaccine against the disease.

Tetanus

A few outbreaks occurred in all the Regions, mostly amongst lambs castrated or docked with the elastrator.

The Onderstepoort vaccine gives adequate protection.

Colibacillosis

There were deaths caused by *Escherichia coli* among calves, lambs and piglets in all the regions. In many cases the presence of *Chlamydia* also played a part.

The severity of this condition in pigs has decreased because the Onderstepoort vaccine for pigs gives good protection. Improved management and hygiene are, however, also necessary.

There were a few cases in poultry in the Highveld Region and in rabbits in the Winter Rainfall Region.

Leptospirosis

There were only three outbreaks in pigs in the Winter Rainfall Region. The combined use of antibiotics and the Onderstepoort vaccine brought the outbreaks under control.

Vibrionic dysentery of pigs

A few cases were diagnosed in the Bloemfontein State Veterinary Area, and in 10 magisterial districts in the Winter Rainfall Region. The regional veterinary laboratory at Stellenbosch examined 61 specimens, 29 of which proved positive.

Pseudomonas infection

This organism was isolated from 113 specimens from mastitis cases in the Winter Rainfall Region. Most of the mastitis remedies in use at present have no effect on this organism and the majority of infected animals die.

In the Eastern Cape and Karoo Region this organism was again isolated from wool showing bluish-green discoloration. Considerably more cases occurred than in the previous year. Because the discoloration of the wool is permanent, it can have economic effects.

Actinobacillosis and actinomycosis

A few cases of these diseases were diagnosed. Cases of actinomycosis were found among impala in the southern areas of the Kruger National Park. *Actinobacillus suis* was isolated for the first time in the Republic from pigs' lungs at the regional veterinary laboratory at Stellenbosch. It may, therefore, together with other organisms, be a factor in the retarded growth of weaned piglets.

Lamb dysentery ("bloedpens")

No cases were reported.

A condition known as "draaiderm" was found in sheep up to the age of 12 months in the Swellendam and Robertson districts. Deaths among such sheep usually occur in the winter months when they

are grazing on green lucerne. Quite a lot of sheep are lost annually. Inoculation with the Onderstepoort lamb dysentery vaccine helps to prevent the disease for up to 2 consecutive years. Thereafter it has no effect.

Foot-rot of cattle and foot abscess of sheep

In spite of the unusually good rainfall, *Fusiformis necrophorus* caused fewer cases than in the previous year in the OFS Region. However, it occurred extensively in the Transvaal and Eastern Cape and Karoo Regions.

A survey was initiated by the Veterinary Research Institute to determine the types of organisms which cause foot-rot and foot abscess in cattle and sheep in SA. *Fusiformis necrophorus* was isolated from cattle with typical symptoms, but hitherto *Fusiformis nodosus*, the cause of the disease in sheep in other countries, could not be found. Various strains of *F. necrophorus* and *F. nodosus* were imported from Australia and the cultivation of the organisms under very strict anaerobic conditions of hoof agar is progressing satisfactorily.

Strangles

No cases occurred.

Protozoal diseases

Babesiosis

Redwater in cattle again caused serious problems throughout the Republic, cases occurring in all the Regions and homelands. In contrast to the previous year, the OFS Region had numerous cases and the incidence of the disease appears to be increasing in the Eastern Orange Free State.

The majority of cattle deaths in the coastal areas of the Eastern Cape and Karoo and Natal Regions were due to redwater. The number of cases also rose in the Winter Rainfall Region, especially along the rivers in the Wellington, Paarl, Caledon and Swellendam districts. This also applies in the Vryheid, Ixopo, Estcourt and Dundee State Veterinary Areas in Natal.

In the Eastern Transvaal Region there were serious outbreaks along the Drakensberg escarpment in the Lydenburg and Pietersburg State Veterinary Areas.

Cerebral redwater (*Babesia bovis*) resulted in losses in the higher lying areas in the Barberton district, as well as in the Pretoria district. In one case 43 cattle died in one week in Pretoria.

Only a few cases were diagnosed in the homelands with the exception of the Transkei. Here the disease was responsible for over 7 000 deaths. Parts of Elliot and Maclear districts in the Eastern Cape and Karoo Region bordering on the Transkei also suffered severe losses.

It was established at the Veterinary Research Institute that the drug Berenil can be very useful in certain cases as an aid for the protection of cattle

during an outbreak of redwater; immunisation can also be carried out immediately. This applies in cases where *Babesia bovis* is responsible for the outbreak. It was also determined that the recommended dose of Berenil has a prophylactic (sterilising) effect on *Babesia bigemina* for 14 days, and suppresses the parasite for a further 14 days. The drug does not prevent infection with *B. bovis*, but has a suppressive effect for about 14 days.

Two outbreaks of *B. bovis* redwater were controlled by immediately injecting all the cattle involved with Berenil and inoculating with the Onderstepoort redwater vaccine, which contains both *B. bigemina* and *B. bovis*, 8 to 10 days later.

A follow-up study showed that 95 per cent of the cattle had *B. bovis* parasites in microscopically detectable numbers in their blood, whereas *B. bigemina* was absent. No further cases of redwater occurred. The unnecessary *B. bigemina* fraction in the vaccine was therefore apparently eliminated while *B. bovis* successfully infected and immunised the cattle despite being suppressed.

The redwater vaccine was improved considerably in the past year. The old vaccine strain of *B. bovis* was replaced by a new one which induced a better immunity and which was partly attenuated by passage in cattle. In addition, the vaccine was standardised to contain about 1×10^7 *B. bovis*-infected erythrocytes per dose. This was accomplished by using only acutely infected splenectomised cattle bred under tick-free conditions at Onderstepoort for vaccine production.

It was also found that the stability of the vaccine is considerably better if ACD is used as the anti-coagulant instead of citrate. These improvements made it possible to extend the stability of the vaccine from four to six days.

As usual **biliary fever** occurred in **dogs** throughout the country. It was diagnosed in **cats** in the Transkei. Isolated cases of **biliary fever** in **horses** were also recorded throughout the country. It occurred fairly generally in the Elliot magisterial district.

Anaplasmosis (gallsickness)

Gallsickness occurred throughout the Republic. There was, however, a noticeable decrease in the number of cases in the Transvaal Region. In contrast to this, the incidence in the Paarl, Wellington and Messina districts increased considerably. More acute cases occurred in the OFS Region and animals died before treatment could take effect.

In the Eastern Cape and Karoo Region, the disease appears to be spreading from Queenstown and Aliwal North towards the Karoo. More cases than usual occurred in kwaZulu. The decrease in the number of cases in the Transvaal Region is attributed mainly to the increased efficacy of the improved Onderstepoort vaccine.

Besnoitiosis (elephant skin disease)

Elephant skin disease was encountered in the Potgietersrus, Louis Trichardt, Vryheid and Hluhluwe State Veterinary Areas. More cases than previously appeared in Bophuthatswana, especially in the Lehurutshe district, where 5 600 cattle were inoculated with the Onderstepoort vaccine by officers. Sporadic cases occurred in Gazankulu, Venda and Lebowa in cattle, such as Africander bulls, which had been introduced into the homelands. The disease is spreading rapidly in the Eastern Caprivi. In some herds up to 30 per cent of the animals are affected.

Good protection is given by the vaccine.

Coccidiosis

There were cases among poultry, lambs and calves throughout the Republic. Rabbits and pigeons were also affected in the Transvaal Region. The incidence of the disease increases when cattle and sheep farming becomes more intensive. Treatment with antibiotics and more efficient management control outbreaks effectively.

Virus diseases

Bluetongue

Notwithstanding the exceptionally high rainfall only sporadic cases occurred, possibly because the farmers inoculated timeously after the problems of the previous year. The western coastal areas of the Winter Rainfall Region were an exception. This disease does not usually occur here, but in one particular case 304 sheep died out of a flock of 1 100. The same problem occurred in the Laingsburg and Ladismith districts.

In the homelands there were cases in Qwaqua, kwaZulu and the Transkei.

Basic research on the nature of immunity against bluetongue was continued at the Veterinary Research Institute. Studies on rabbits have shown that the route of immunisation has an influence on the quantity of antibodies that are produced. The best results are obtained with the intra-muscular route. The use of an oil-adjuvant together with the bluetongue virus enhanced the response.

By using the haemolytic plaque test, which has been developed for the identification of cells which manufacture antibodies against the bluetongue virus, it could be demonstrated that the immune reaction against bluetongue in mice follows the usual pattern. After the initial vaccination cells which form the bigger type of antibody (IgM) reach maximum numbers after three to four days. These are quickly followed by cells which form a smaller type of antibody (IgG), reach maximum counts in five days, and decrease rapidly afterwards. Further inoculations stimulate IgG-forming cells in particular. There is thus a typical primary immune reaction in mice which is followed by an equally characteristic secondary reaction.

Considerable research is being done towards

the improvement of the vaccine against bluetongue. Since basic research work has shown that approximately 80 per cent of the virus produced in tissue culture is cell bound, a simple method is now being sought to free the virus in order to obtain a higher yield. If the attempts to reach this goal are successful, it ought to be possible to prepare an inactivated vaccine against bluetongue.

Horse-sickness

As was the case with bluetongue, this disease did not reach serious proportions in most parts of the country. In the Winter Rainfall Region, however, deaths occurred in parts of the Calvinia State Veterinary Area where for 20 years there had been no cases. The Eshowe and Umzumbe districts in kwaZulu also had more cases than usual.

The strain of the virus which caused problems in the North-Eastern Transvaal has now been included in the standard Onderstepoort horse-sickness vaccine.

The susceptibility of zebras to the horse-sickness virus has long been known, but no details in connection with such aspects as the level and duration of viraemia have been noted. Recent surveys in the Kruger National Park have shown that the serum of some zebras contained neutralising antibodies against certain types of horse-sickness virus, whereas other zebras were fully susceptible. After artificial infection with Type 3 virus, the fully susceptible zebras showed viraemia from day 3 to day 14. Mild clinical symptoms of horse-sickness were also evident. On the 20th day the virus could still be isolated from the lymph nodes and spleen. Low-grade viraemia was noticed on day 17 and day 20 in zebras with heterologous immunity. One of these zebras was slaughtered on the 40th day but no virus could be found in the organs. The zebras which were not killed for experimental purposes had high concentrations of antibodies against Type 3 horse-sickness virus on day 40.

Young elephants were also infected artificially with horse-sickness virus. No virus could, however, be isolated from their blood at any stage, and no neutralising antibodies had been formed either.

The plaque selection technique was used by the Veterinary Research Institute to select further safe and effective strains of horse-sickness virus which might be suitable for vaccine production. Three strains have already been isolated for this purpose and incorporated in the vaccine.

Heartwater

This disease took its usual toll in the infected areas except in the Louis Trichardt State Veterinary Area, where considerably more cases occurred among small stock. Intraperitoneal administration of antibiotics has given outstanding results in this area in the treatment of heartwater in small stock.

The incidence of the disease is increasing in Natal. Infection has gradually spread from the bushveld areas up the larger rivers and there are already infected foci around Glencoe. The movement of sheep from one place to another was re-

sponsible for establishing the disease in Umvoti. The disease also caused serious problems at the Animal and Dairy Science Research Institute at Irene, where it occurred for the first time.

During the year under review, unlike the previous year, no cases occurred in Umtata, although the disease caused losses in the eastern coastal areas of the Transkei.

Ephemeral fever

As in the previous year, three day stiffness reached serious proportions in the Eastern Transvaal, Transvaal and Highveld Regions. Deaths occurred in these Regions and in the OFS Region. There even was an outbreak among imported cattle at the Jan Smuts quarantine station. There were numerous cases in the Eastern Cape and Karoo Region, but there were no deaths from the disease. There were fewer cases in Natal than last year, except in the Vryheid and Hluhluwe State Veterinary Areas, where the infection was severe.

Cases also occurred in all the homelands. Severe emphysema of the lungs, sometimes accompanied by subcutaneous emphysema, occurred as an alarming, usually fatal, complication in many cases. It was possible to isolate the causative virus at the Veterinary Research Institute from such cases, thereby confirming the nature of the disease.

The technical problems associated with mass production of the attenuated vaccine that has been developed against ephemeral fever were overcome this year and the vaccine was recently released for use by farmers.

Rift Valley fever and Wesselsbron disease

Rift Valley fever, as in the previous year, caused severe losses. The North-Western Cape, Orange Free State, Eastern Cape and Karoo were the worst affected.

In the Calvinia State Veterinary Area abortions and deaths occurred in both sheep and cattle from September 1974. There was a new outbreak in the OFS Region in January 1975. Cattle were predominantly affected. It spread in a north-westerly direction along the Orange River. During March 1975 it also appeared among sheep. For some inexplicable reason the Transvaal only had a few outbreaks, the most northerly of which was in the Nile River valley near Potgietersrus. East Griqualand had a serious outbreak in cattle but Zululand had only a few cases.

From the middle of May the number of outbreaks decreased considerably.

None of the homelands had serious problems with this disease.

An inactivated vaccine, intended mainly for cattle, was released by Onderstepoort this year. It has yielded outstanding results although abortions still occurred up to two weeks after inoculation.

A few cases of *Wesselsbron disease* were reported from the OFS Region.

Experimental cases of Rift Valley fever were produced from time to time at the Veterinary Re-

search Institute at Onderstepoort. This provided the opportunity for an intensive study of the pathology of the disease in mature sheep, lambs and aborted lambs. Not only did this investigation confirm known aspects of the pathology of Rift Valley fever, but some new information was also forthcoming. Severe kidney lesions in the form of degeneration and a glomerulitis were, for example, seen for the first time in mature sheep. The lambs showed very pronounced liver lesions. Very extensive necrosis occurred and was often accompanied by mineralisation.

Although the mortality was not as high in cattle as in sheep, specimens were also received from mature cattle, calves and aborted foetuses. To a large extent the lesions corresponded with those found in sheep. Extensive haemorrhages generally occurred in the liver, gall-bladder and other organs, including the digestive tract, and jaundice was sometimes also present.

Since Wesselsbron disease occurs in the same areas and is difficult to distinguish from Rift Valley fever, comparative studies were conducted. The incidence of Wesselsbron disease was lower than that of Rift Valley fever and only specimens from lambs and calves were received. The lesions were largely confined to the liver and were less pronounced than in Rift Valley Fever. The calves, however, showed very pronounced jaundice.

As a result of the extent of the Rift Valley fever epizootic, many farmers inoculated their pregnant ewes with the live vaccine, despite warnings against this practice. This caused not only abortions, but also large outbreaks of hydrops amnii (abnormal accumulation of placental fluid). The lambs of such ewes usually showed developmental abnormalities such as underdevelopment and/or total absence of brain structures, and skeletal, limb and muscular abnormalities, which prevented ewes from lambing normally. This caused further losses.

Bovine malignant catarrh (snotsiekte)

There were a few cases in the Rustenburg, Louis Trichardt, Lydenburg, Eshowe, Hluhluwe and Ixopo State Veterinary Areas. In all cases there had been contact with blue wildebeest (gnu).

Jaagsiekte (pulmonary adenomatosis)

Jaagsiekte or pulmonary adenomatosis was diagnosed in a few instances in the OFS Region. Few sheep were involved. It appears that the disease may be endemic on two farms in the Cathcart district. Outbreaks also occurred in the Barkly East, Estcourt, Bethlehem, Namaqualand and Kroonstad districts. Only one case was found in East Griqualand this year.

Research on jaagsiekte at the Veterinary Research Institute showed considerable progress during the past year. The disease was transmitted experimentally for the first time by subinoculation of a culture of tumour cells isolated from the lungs of a sheep with jaagsiekte and grown *in vitro* for a

year, during which the cells were passaged 25 times. Since this cell line is free from demonstrable infectious agents, this excludes everything except latent viruses as possible causes of the disease.

A herpes virus very similar to viruses associated with human cancers was isolated from another jaagsiekte case. However, attempts to demonstrate a serological relationship between this virus and jaagsiekte cases, or to produce jaagsiekte by sub-inoculation of the virus, have failed.

Infectious ophthalmia

This was reported from the OFS and Highveld Regions only. Sheep in the OFS Region that had been inoculated with *Chlamydia* vaccine were protected to some extent against the disease.

Contagious pustular dermatitis (Vuilbek)

Serious outbreaks of orf occurred in the Eastern Cape and Karoo, OFS and Winter Rainfall Regions and there were a few cases in the Highveld Region. Lambs in the Orange Free State developed lesions on the coronet and most of those affected in this way died.

State veterinarians had difficulty in preparing sufficient quantities of autogenic vaccine because of the extent of the outbreaks. The State Veterinarian at Calvinia did not prepare any vaccine but treated the animals with a mixture of iodine and raw linseed oil in a 1:1 mixture with good results.

Mucosal disease

No cases were reported.

Virus diseases in cattle feedlots

The project to produce an inactivated combined vaccine against infectious bovine rhinotracheitis and para-influenza 3 had to be abandoned by the Veterinary Research Institute because of difficulties experienced in producing the large quantities of the virus required. An attenuated vaccine for experimental purposes has, therefore, been developed instead. Since the vaccine can induce abortions its use will be limited to feedlots. Further research is being undertaken to eliminate this complication.

Fungal diseases

Ringworm

This was widespread in the Eastern Cape and Karoo Region, especially in the Sterkstroom district.

Lumpy wool

The humid conditions caused severe outbreaks of this condition in the Karoo but it was possible to control it effectively.

Infertility and venereal diseases

General

Breeding problems were encountered in all the Regions. The commonest causes of such problems in cattle in the Natal and OFS Regions were poor management, incorrect feeding and malnutrition. Where these were corrected and breeding was still unsatisfactory, specific investigations for the presence of venereal diseases were undertaken.

The AI and Reproduction Section of the Division of Veterinary Services has examined 95 herds (4938 animals) during the past year - 50 herds and 2228 animals more than during the previous year.

In order to make it possible to diagnose such diseases more accurately, the regional veterinary laboratories at Stellenbosch, Allerton and Middelburg (Cape) have been supplied with more sophisticated apparatus.

Stellenbosch has already investigated 25 herds of cattle with breeding problems and found infection with a venereal disease in 40 per cent of these. Many farmers use AI in their herds but still keep a couple of bulls for heifers or cows that do not conceive after one or two inseminations. Most of the infections isolated were found in such bulls.

Two studs with breeding problems were also visited. In both cases *Corynebacterium equi* was isolated from the semen of the stallions. Vaginal smears from the mares revealed *Streptococcus* spp. and fungi.

Rams were examined for fertility by the Swellendam and Calvinia State Veterinarians. Up to 10 per cent of the rams were found to be unsuitable for breeding purposes because of testicular and scrotal abnormalities. Similar examinations were undertaken by officers of the regional veterinary laboratory at Middelburg (Cape).

Vibriosis

Infections with vibriosis were diagnosed in all the regions with the exception of the Eastern Cape and Karoo Region.

The regional veterinary laboratory at Stellenbosch carried out 25 herd investigations and found vibriosis, alone or together with trichomoniasis, in five herds.

The AI and Reproduction Section of the Division of Veterinary Services found vibriosis, either alone or together with trichomoniasis, in 50 herds (18 in 1973/74). When the Section carried out follow-up examinations of two herds where vibriosis had been present and which had been inoculated with the Onderstepoort vibriosis vaccine, it was found that in one herd 88 per cent of the cows were in calf in comparison with 28 per cent the previous year. In the other herd the relevant percentages were 98 and 30. It should be mentioned that in the first herd trichomoniasis was also present.

The fluorescent antibody technique has been used successfully at the Veterinary Research Institute for the identification of *Vibrio fetus*. In addi-

tion to 120 isolates from the genital tracts of cattle, the organism could also be isolated from specimens obtained from aborting pigs and sheep. This is the first time that *V. f. intestinalis* has been associated with abortion in pigs.

The investigation of the efficacy of an inactivated trivalent vaccine against vibriosis of cattle has been completed. It was found that 2 ml doses of the more concentrated vaccine, which contains one of the new emulsifying agents, caused relatively small swellings at the inoculation site. The vaccine protected 100 per cent of vaccinated heifers against challenge, whereas *V. fetus* could be isolated for several weeks from control heifers. The vaccine also has curative properties for infected heifers and bulls, but better results were obtained with 5 ml than with 2 ml doses.

The five-year-old survey on the incidence of *V. fetus* in cattle in SA was continued. The overall incidence, as determined by examination of 4840 sheath washings of bulls, vaginal mucus specimens and cervical biopsy material of heifers and cows, was only 3 to 4 per cent. This is considerably lower than the 10 to 13 per cent recorded last year and can probably be ascribed to the increasing use of the Onderstepoort vaccine which was released for general use this year.

According to all the Regions the results obtained with this vaccine are excellent.

Trichomoniasis

Sheath washings from 1 042 bulls were examined by researchers at the Veterinary Research Institute; 59 (5.5 per cent) were found to be positive. Mixed infections of *T. foetus* and *V. fetus* occurred in 19 (1.8) per cent of the bulls. Since it is impossible to distinguish clinically between the two infections, it is always advisable to make a tentative diagnosis until the causative organisms have been identified.

Cases of trichomoniasis were positively diagnosed in all the Regions except the OFS and Eastern Cape and Karoo Regions. In Natal one positive case, the first for many years, was found at Umvoti.

Of the 25 herds examined by the Stellenbosch regional veterinary laboratory, seven were infected with trichomoniasis, alone or together with vibriosis.

The AI and Reproduction Section of the Division of Veterinary Services diagnosed similar infections in 19 herds this year. The Section experimented further with the treatment of bulls against trichomoniasis. New methods of treatment, safer and more time saving, were tested. A total of 54 bulls in 31 herds were treated, with promising results. Research on this matter is continuing.

A practical method of diagnosing trichomoniasis on the farm was developed by the Section. In co-operation with the Reproduction Section of the Veterinary Research Institute, a serum agglutination test is being used to determine the strains of *Trichomonas foetus* that occur in the Republic. So far *T. foetus* var. Belfast appears to be the only organism implicated.

Chlamydiosis

This disease was again widespread, but the incidence has decreased a great deal.

Considerably fewer abortions occurred, although the organism was isolated in a large variety of specimens. All types of animal were affected.

After Rift Valley fever had raged through the OFS Region, there were numerous outbreaks of chlamydiosis among cattle. The symptoms usually found were abortions, retained afterbirths, metritis, anoestrus and weak calves.

There was a severe outbreak among rabbits at Harrismith and 2 000 died. Chlamydiosis is still the commonest condition among rabbits in the Winter Rainfall Region and it could critically affect rabbit farming there. Horses and cattle were less affected than other stock in the Eastern Cape and Karoo Region. *Chlamydia* organisms caused conjunctivitis in sheep in the Amersfoort district.

Cows injected at the Veterinary Research Institute with low doses of a bovine strain of *Chlamydia* during pregnancy did not abort, despite the fact that the infection was transmitted transplacentally to their calves. None of the calves died; they were apparently born with a resistance, but their birth mass was lower and their initial increase in mass slower than that of calves of non-infected control cows. Chronic chlamydiosis lesions in the kidneys, intestines and (sometimes) lungs were seen in the calves of infected cows. Large numbers of *Chlamydia* could be found in intestinal smears. It would therefore appear that calves born with the infection remain carriers of the organism for a long time. All the calves of the non-infected cows died within a month of birth from an acute form of chlamydiosis which they apparently contracted from the infected animals.

The Onderstepoort vaccine for sheep gives excellent results.

Actinobacillus seminis

This organism again affected rams in the Winter Rainfall, Eastern Cape and Karoo and OFS Regions. It is particularly important in stud flocks because a stud ram becomes infertile and thus valuable blood lines are lost.

Studies on the cause of the "Epivag" syndrome in cattle

Heifers which had been served by bulls with typical epididymitis and vesiculitis showed a pronounced vaginitis with a copious purulent discharge. Nevertheless, most heifers contracted an infection with micro-organisms. *Chlamydia psittaci* and *Ureaplasmas* ($\frac{1}{2}$ *T. mycoplasmas*) could regularly be isolated from these heifers. Heifers that were served by one bull developed anterior vaginitis while those served by another bull showed a posterior granular vaginitis. Bulls which served these heifers have not shown any abnormalities of the genital organs, although the organisms mentioned above could be isolated from their semen.

Studies on peri-natal and pre-natal deaths

The Veterinary Research Institute continued the comprehensive nation-wide investigation into the infectious causes of peri-natal and pre-natal deaths.

(i) CATTLE

Chlamydia was apparently once again the commonest infectious cause of abortion in cattle. The organism could be isolated from 69 per cent of the 956 foetuses and still-born calves examined, in some cases together with *Brucella abortus*, *Escherichia coli*, *Vibrio fetus*, *Coxiella burnetti* and the Rift Valley fever virus.

Brucellosis was diagnosed purely by examination of foetal material, in 47 herds, i.e. about 6 per cent of the 834 outbreaks examined. These figures include a few stud breeders who have conscientiously been applying the recommended heifer vaccination programme. Approximately 12 per cent of the 26 000 selected cattle examined serologically were positive for brucellosis.

Rift Valley fever was responsible for 26 of the outbreaks of abortion examined. The disease was widespread in South Africa, occurring in the Rustenburg, Thabazimbi, Bethal and Standerton districts of the Transvaal; it has not occurred in these districts for many years. Only a few of the bovine foetuses that were examined showed typical lesions. In the others a general examination for pathogenic organisms revealed the presence of the virus. It is therefore essential to apply virus isolation techniques to diagnose the disease. In some cases the virus was isolated together with other pathogenic organisms like *Brucella* and *Chlamydia*.

Q-fever, caused by *Coxiella burnetti* was diagnosed in three cattle herds and is probably a more important cause of pre-natal losses than is generally accepted.

Mucosal disease was shown to be the probable cause of abortion in 10 cases.

(ii) SHEEP

The incidence of chlamydiosis was considerably lower than in the previous year. *Chlamydia psittacei* could only be isolated from 18 per cent of the 387 sheep foetuses, still-born lambs and lambs that died shortly after birth. The lower incidence can probably be ascribed to the increasing use of the Onderstepoort vaccine. Other pathogenic organisms, such as the Rift Valley fever-virus and *C. burnetti* occasionally occurred in the same foetus.

By combining direct microbiological techniques with serological examinations, it was possible to diagnose Q-fever in six flocks with peri-natal losses.

As in cattle, abortions caused by Rift Valley fever were very extensive. The virus concerned could be isolated from material obtained from 17 outbreaks of abortion.

(iii) OTHER ANIMALS

Chlamydiosis was apparently the most important cause of abortion in antelopes and laboratory animals like rabbits. *Chlamydia* was also isolated from pig foetuses. *Leptospira pomona* was responsible for two abortion storms and *Vibrio fetus intestinalis* could be isolated from the faeces of sows that aborted.

DISEASES OF CALVES

White scours

Infection by *Escherichia coli* again caused serious losses throughout the White areas of the Republic. Cases also occurred in Venda. As usual the occurrence of the disease was associated with bad management and poor hygiene. Much of the natural fresh water in Natal, even from boreholes, is infected with these organisms and serious problems were encountered in the Ixopo, Vryheid, Estcourt and Eshowe State Veterinary Areas.

The disease also made its appearance in the extensive cattle-farming areas of the Kimberley district. Farmers in the Winter Rainfall Region formed a committee to investigate and control diseases of calves. The regional veterinary laboratory at Stellenbosch is rendering valuable assistance in this regard.

The disease can be prevented by the inoculation of pregnant cows with the Onderstepoort vaccine, together with improved management and hygiene.

Paratyphoid

Only sporadic cases occurred except in Vryheid and Zululand, where serious problems arose even among calves on extensive cattle farming establishments. In Malmesbury and Piketberg up to 50 per cent losses occurred on farms where calves are reared. Many farmers in these districts do not rear their calves themselves, but sell them to others who raise them and resell them as heavily pregnant heifers. This practice results in various strains of *Salmonella* being frequently found on such farms.

This disease can be eradicated by inoculating with the Onderstepoort vaccine and practising good management and hygiene.

The present attenuated vaccine against paratyphoid induces reasonably satisfactory immunity under normal circumstances, but has inherent weaknesses which sometimes lead to unsatisfactory results. Work on improving the vaccine was therefore undertaken at the Veterinary Research Institute. Experiments with mice showed that the attenuated vaccine induced less satisfactory immunity against challenge with homologous and heterologous *Salmonella* species than a dead formalin-inactivated and alum-precipitated vaccine. There are already indications that these findings also apply to calves.

Specimens examined at Onderstepoort showed that *Salmonella dublin* is the commonest cause of paratyphoid in calves (48/91 cases); *S. bovis morbi-*

ficans (16/91) and *S. typhimurium* (7/91) occurred less frequently.

Various serotypes of *Salmonella* were also isolated from poultry, pigs, sheep, horses and guinea pigs.

Coccidiosis

Isolated cases occurred among calves in all the regions. Coccidiosis causes serious problems in the Natal bushveld.

Outbreaks can be effectively controlled by means of treatment and the application of the necessary grazing control measures.

Calf diphtheria

Isolated cases were reported from the Bethlehem, Potchefstroom, Johannesburg, Fauresmith, Ixopo and Malmesbury State Veterinary Areas.

Sweating sickness

There was a high incidence in the Potchefstroom State Veterinary Area and similar circumstances prevailed in the Rustenburg State Veterinary Area. Cases were also encountered in the Natal and Eastern Transvaal Regions, and in Venda, Lebowa, Bophuthatswana and kwaZulu.

Virus pneumonia

One case each was reported from the Highveld and Natal Regions.

Reovirus

Evidence has been obtained by the Veterinary Research Institute that reovirus, a cause of diarrhoea in calves, is present in South Africa. The FA technique was used to detect this virus in frozen sections of the intestinal walls of calves suffering from diarrhoea. The specimens were collected immediately after the diarrhoea had started. This virus must be held responsible for two outbreaks of diarrhoea that were investigated.

Post-natal mortality in calves

A more detailed investigation into this important problem was conducted by the Veterinary Research Institute on calves presented for *post-mortem* examination at Onderstepoort. Although well-known diseases, like heartwater, verminosis and various types of poisoning, were responsible for a fair number of the deaths, it is clear that disease complexes in which one or more causes played significant primary or secondary aetiological roles were the most important causes of calf mortality.

A very high incidence of infection with *Chlamydia psittaci* was found in calves, but in approximately half the cases it occurred as a complication of other diseases such as white scours (*Escherichia coli* infection) and paratyphoid (salmonellosis). Simultaneous infection with

Chlamydia and *E. coli* apparently increased the pathogenicity of *E. coli*. *E. coli* was the second most important cause of disease in calves, *Chlamydia* being the most important. *Chlamydia* was present in some calves that died from other causes, the animals apparently being carriers of the infection.

Chlamydia was also isolated from 421 (80,5 per cent) of the faeces specimens of calves examined for it. This was part of a survey to determine the incidence of this infection. It showed that a wide range of specimens from suspected cases should be examined. The organism could invariably be isolated from the spleen, brain, gall bladder, kidney and lungs of infected animals.

Poor management was directly responsible for considerable mortality, and incorrect feeding and housing practices and other stress factors, which create favourable conditions for some of the above-mentioned diseases, probably contributed largely to this very serious problem.

DISEASES OF POULTRY

Infectious bronchitis

The State Veterinarian at Bloemfontein diagnosed the disease among broilers in several flocks. The egg production of laying hens at the Glen College of Agriculture decreased by over 70 per cent during an outbreak. The Stellenbosch regional veterinary laboratory did 54 *post-mortem* examinations on fowls that were infected with the disease.

No cases were reported from the other Regions. This was attributed to the use of the Onderstepoort vaccine by poultry farmers.

Infectious coryza

There were no outbreaks. An infectious coryza vaccine was released by Onderstepoort during the year.

Mycoplasmosis

Isolated cases of chronic respiratory disease (mycoplasmosis) were reported. It is still the most prevalent poultry disease in the Winter Rainfall Region and the Bloemfontein State Veterinary Area.

Fowl pox

The use of the Onderstepoort vaccine has reduced the incidence of this disease to isolated outbreaks.

Gumboro disease

This again caused problems among broilers in the Winter Rainfall Region.

Epidemic tremor

An outbreak occurred in the Bethlehem State Veterinary Area.

DISEASES OF FISH

In view of the predicted shortage of protein, the Veterinary Research Institute at Onderstepoort started giving attention to diseases of fish. After a thorough investigation a disease which caused heavy mortality among trout was ascribed to a bacterial infection caused by a *Streptococcus*. Antibigrams showed that this organism is sensitive to tetracyclines, and it was possible to control the outbreak by the feeding of food containing 3 500 parts per million of the drug.

The cause of a fatal disease among trout, in which pronounced anaemia and a deposit of ceroid (a yellow pigment) occurred in the liver and kidneys, could not be established. It appears likely that the disease is connected with feeding.

Reasonably high concentrations of arsenic were found in the tissues of barbels *Labeo umbratus* found dead in a river. The fish had apparently died from arsenical poisoning. The arsenic probably came from a dipping tank.

The toxicity of anionic detergents of the alkylbenzene sulphonate type was investigated as a result of reports of fish mortality in certain small trout streams in Natal after the illegal use of these detergents to render the fish unconscious. The commercial product still proved to be fatal to fish in a dilution as low as 5 parts per million.

DEFICIENCY AND NUTRITIONAL DISEASES

Malnutrition and deficiencies due to protracted droughts have not been so noticeable this year. However, deaths from drought did occur along the Drakensberg in Natal during the spring. Problems are encountered in all the homelands during winter and early spring, mainly on account of overstocking of the available grazing.

By testing liver specimens, the Stellenbosch regional veterinary laboratory has drawn up a list of the normal values of trace elements in the livers of all animals, poultry and ostriches in the Winter Rainfall Region. The metabolic profile of horses is being statistically calculated by computer and will be released in due course.

A **phosphate deficiency** was found in all the regions, but was not as important as it used to be. An increasing number of farmers are realising the value of phosphatic licks in difficult times.

Few or no licks are administered in the homelands and aphosphorosis is therefore a serious problem there.

Vitamin A deficiency caused blindness and decreased fertility in the Winter Rainfall Region. Poultry were affected in the Bethlehem State Veterinary Area.

Vitamin B 1 deficiency resulted in cerebro-cortical necrosis in sheep at Ceres and Caledon.

Vitamin E deficiency: Poultry were affected in the Highveld and OFS Regions. Vitamin E and selenium deficiencies in pigs were found on three farms in the Eastern Transvaal Region. The farms were using food from the same company.

As in the past, the coastal areas of the Winter Rainfall Region were severely affected by a deficiency of **copper** in the grazing. Cases of swayback in sheep and decreased fertility in cattle were encountered where supplementary copper was not administered.

During a survey to determine the trace element position among Angora goats in the Eastern Cape and Karoo Region, copper deficiency in the livers was found only in certain parts. No other trace element deficiencies were detected.

Symptoms of deficiencies were also found in the Zululand bushveld, and the Fouriesburg and Bethlehem districts.

Magnesium deficiency caused diarrhoea and stiffness in cattle and sheep grazing on green feed in the Queenstown district. In the same circumstances, sheep and cattle were again affected in the Eastern, Central and Southern Orange Free State. A lick containing 1 to 2 per cent magnesium sulphate corrected the deficiency.

A **calcium deficiency** resulting from an incorrectly compounded ration caused deaths among young turkeys at the Glen College of Agriculture.

Decreased fertility ascribed to an **iodine deficiency** was encountered along the Drakensberg and at Ixopo and Howick in Natal.

Zinc deficiency was detected among cattle in the Bethlehem State Veterinary Area this year.

A complex imbalance or deficiency of trace elements was found on the Vaalharts Irrigation Scheme. It resulted in retarded growth. The direct cause has not yet been determined.

Enzootic icterus did not cause as many losses in the Eastern Cape and Karoo Region as previously.

Pregnancy toxæmia (domsiekte) caused deaths among sheep in the Winter Rainfall, Eastern Cape and Karoo Regions.

Cases of **acidosis** were encountered in sheep on green grazing in the Winter Rainfall Region. Sheep that overfed on grain also developed this condition. Five cattle and 3 sheep died of acidosis in the Bethlehem State Veterinary Area after overeating themselves on whole maize.

POISONING

Mineral poisoning

Cases of mineral poisoning were reported from everywhere except the homelands. There were isolated cases of malicious poisoning but otherwise cases were due to carelessness or to the incidental intake of the poisonous substance.

Arsenic still takes an annual toll. Fourteen calves died in the Louis Trichardt State Veterinary Area after being treated with an arsenical dip that was too strong. Animals also died from arsenical poisoning in the Wellington district and the Bethlehem, Kroonstad and Mafeking State Veterinary Areas.

Insecticides containing organic phosphates and/or chlorinated hydrocarbons were responsible for a large number of deaths.

Dieldrin mixed with bird seed killed virtually all the canaries at Middelburg (Cape). Fowls that ingested the same bird seed also died. In Ermelo pigeons and fowls died after being fed chicken feed contaminated with dieldrin. A total of 6 cattle and 26 sheep died of this poison in the Bethlehem State Veterinary Area. Other cases occurred in the Stellenbosch State Veterinary Area.

Organic phosphates caused the death of five cattle in the Mafeking State Veterinary Area, and 11 cattle and two dogs died in the Piet Retief State Veterinary Area.

Licks containing **urea** caused considerable losses, as in the past. In the Mafeking State Veterinary Area 87 cattle were affected but the animals were treated and only seven died. Urea poisoning was the most prevalent type of poisoning in the OFS and Transvaal Regions. Cases also occurred in the following State Veterinary Areas: Bethlehem, Kroonstad, Louis Trichardt and Lydenburg.

In Bredasdorp 52 sheep died after a commercial remedy containing **copper** had been administered. Copper poisoning killed 35 sheep near Brakpan. The source could not be determined. In the Williston district 45 sheep died as a result of copper poisoning. Fatal cases also occurred in the Wellington district.

Twelve cattle died of **lead** poisoning in the Mafeking State Veterinary Area. Twelve sheep were also affected in the Potchefstroom Veterinary Area, but treatment was given and only three died. Cases were also reported from the Wellington district.

Salt poisoning was responsible for the death of 16 pigs in transit by train from Worcester to an abattoir in Cape Town. In all 78 cattle and sheep died in the Swellendam State Veterinary Area. Salt poisoning also caused the death of sheep in the Kimberley district.

Malicious **nitrate** poisoning caused the death of 20 cattle in the Pietersburg State Veterinary Area. Cases in the Kuruman - Vryburg area resulted from the high mineral salt concentration in the borehole water. As a result of evaporation from storage dams, their contents eventually contained toxic concentrations of nitrates. One bovine died in the Kroonstad State Veterinary Area.

After they had been dipped in **zinc phosphide**, eight sheep died in the Louis Trichardt State Veterinary Area. Zinc sulphate instead of monosodium sulphate was sold to a farmer in the Eastern Cape and Karoo Region, causing him to lose 100 out of 500 sheep after dosing them with it.

Cases of **strychnine** poisoning among dogs occurred throughout the Republic, especially in the towns. In Jagersfontein 60 dogs died of strychnine poisoning and in Piet Retief 14 dogs died owing to a farmer's negligence.

The establishment of an effective diagnostic service in toxicology at the Veterinary Research Institute is still being complicated by the fact that the public submit specimens to be examined for the presence of toxic substances without being able to furnish the necessary particulars regarding the history, symptoms and *post-mortem* lesions.

The **chlorinated hydrocarbon insecticides** are still important causes of poisoning. The poisoning of cattle and birds inadvertently fed with seed treated with dieldrin occurred, and was established by the Veterinary Research Institute.

Relatively few cases of poisoning by organic-phosphate pesticides are confirmed chemically by the Veterinary Research Institute. The reason for this is probably that these substances are swiftly degraded biologically rather than a low incidence of such cases. The surest and quickest indication of poisoning by organic phosphates is obtained from blood collected in heparin from suspected cases. Such specimens, however, are seldom received. One farmer lost nearly 600 sheep from parathion poisoning when he inadvertently used a spray intended for crops as a dip. While dealing with the poisoned sheep, he and his labourers were also affected. Organic-phosphatic dips have repeatedly caused poisoning in young calves and firms are now requested to provide specific proof that individual products are safe to use with calves.

Cases of *anenical poisoning* are less frequent because the dip is no longer readily available. It has been established by the Veterinary Research Institute, however, that the water in dip tanks in which arsenic has not been used for several years may still absorb enough arsenic from the sides of the tanks to cause death if accidentally taken in by animals.

Because they are potentially dangerous the registration as cattle feed of urea-containing licks in a mash form is no longer unconditional. However, this is not necessarily the reason for the decrease in the incidence of urea poisoning recorded this year. Most cases are apparently diagnosed in the field without being referred to Onderstepoort.

An interesting occurrence observed this year was that borehole water which was previously potable caused nitrate poisoning. The explanation of the Veterinary Research Institute was that the heavy rains caused large quantities of water to drain into the lower strata of the soil, passing through layers with nitrate deposits in the process and dissolving the nitrates, which then found their way into the borehole water.

Plant poisoning

According to reports by the Regions and homelands, the following plants caused stock deaths:

Homeria and Moraea spp. (tulp) in all seven Regions; *Senecio* spp. in the Transvaal, Highveld, Natal, Eastern Cape and Karoo and Winter Rainfall Regions, as well as the Transkei; *Urginea and Ornithoglossum* spp. (slangkop) in the Highveld, OFS and Eastern Cape and Karoo Regions; *Pachystigma, Pavetta and Fadogia* spp. (gousiekte) in the Highveld, Natal and Eastern Transvaal Regions; *Geigeria* spp. (vermeerbos) in the OFS and Highveld Regions; *Crotolaria* spp. in the OFS and Winter Rainfall Regions, as well as Lebowa; *Lantana camara* in the Eastern Transvaal and Natal Regions; *Dichapetalum cymosum* (gifblaar) in the Transvaal and Highveld Regions; *Ornithogalum ornithogaloides* (chinkerinchee) in the Eastern Cape



An animal is dosed with a suspected plant poison mixed with water

and Karoo and Winter Rainfall Regions; *Chrysocoma tenuifolia* (bitter Karoo) in the OFS and Winter Rainfall Regions; *Cestrum* spp. in the Natal Region; *Galaenia africana* (waterpens), *Cotyledon* spp. (krimpsiekte), *Asaemia axillaris* (vuursiekte), *Cynanchum* spp. (monkey rope), *Argemone subfusiformis* (Mexican poppy), *Hermannia paucifolia* (Scholtz bush), *Malva parviflora* (kiesieblaar), *Sarcostemma viminalis* (climbing milkweed), *Melianthus major* (honey flower), *Zygophyllum microcarpum* (sandripuis) in the Winter Rainfall Region; *Microcystis toxica* and *Solanum kwebense* (maldronksiekte) in the Transvaal Region; *Datura* spp. and *Brassica* spp. in the Highveld Region and *Dipcadi glaucum* in the Eastern Transvaal Region.

Plants containing **oxalic acid** caused problems in the Winter Rainfall Region.

Prussic acid poisoning occurred in all the Regions except the Natal and Transvaal Regions.

Dichapetalum cymosum caused the death of 20 impala, two kudu and two duikers at Rustenburg after the veld had been burnt.

Geeldikkop was only encountered in the Winter Rainfall Region, and balls formed by the seeds of *Aristida* grasses also caused problems there.

Photosensitisation as a result of the ingestion of plants was found in the Highveld and Winter Rainfall Regions.

The plant *Senecio harveianus*, which is indigenous to the Bethlehem district where emaciation

and mortality among sheep occurred, was tested at Onderstepoort and, for the first time, found to be poisonous at 10 g/kg.

Toxins

Diplodea zeae poisoning was reported from the Highveld and Natal Regions.

Aflatoxicosis caused by mouldy groundnuts was diagnosed in fowls in the Eastern Transvaal Region. Mouldy hay was the cause of paralysis and endotoxaemia in dairy cows on farms in the OFS Region.

Lupinosis

A chemical pathological test for liver damage, in general use for humans, has been successfully adapted at the Veterinary Research Institute for the study of liver damage caused by lupinosis. Lupinosis is a mycotoxicosis characterised by liver damage and is caused by a fungus growing on lupins. The activity of the enzyme -glutamyl transpeptidase (-GT) was measured by means of this test. The -GT test proved to be of great diagnostic value, particularly in cases of chronic liver damage in which other tests give negative results. Early acute poisoning could also be detected more readily with the help of this test.

An outbreak of an unknown, highly lethal disease, characterised by severe muscular tremors, hypersensitivity, ataxia, paresis and paralysis, oc-

curred among cattle on a farm in the northern Transvaal during February 1975. Within three weeks, 130 out of 330 cattle died, 70 affected carcasses were condemned at the abattoirs and 60 bovines suffered various degrees of irreversible brain damage.

Poisoning was suspected and the various components of the ration, which consisted of cracked maize, citrus meal and a residue of Bantu beer called "maroek", were fed separately to cattle at the Veterinary Research Institute at Onderstepoort to determine which one of them was responsible. It was established that the toxicosis was caused by the "maroek" fraction. Tests for known toxic substances were negative, but careful inspections revealed that the "maroek" was mouldy. It was therefore suspected that the disease was a mycotoxicosis.

The history of the outbreak indicated that the "maroek" had become toxic on the farm within 2 days of being received from the brewery. *Aspergillus clavatus*, a quick-growing, dominant fungus isolated from the "maroek", was singled out for toxicity tests. The fungus was grown in bulk on "maroek" and dosed to cattle which developed typical symptoms of the disease, thereby proving that it was responsible for the disease.

INTERNAL PARASITES

The excessively high rainfall created particularly favourable conditions for internal parasites. On farms in the OFS Region dosing had to be repeated every two to three weeks in order to control the parasites. The exception was the Winter Rainfall Region, where conditions were not so favourable for the parasites.

Haemonchus spp. (wireworm) was the commonest internal parasite in all the Regions except the Winter Rainfall Region. There were also heavy infestations in Lebowa and Bophuthatswana.

Oesophagostomum spp. (nodular worm) was widespread in Lebowa and the Eastern Cape and Karoo (where it had previously been insignificant), OFS, Natal and Transvaal Regions.

Trichostrongylus spp. (bankrupt worm) was important in the Eastern Cape and Karoo, OFS, and Winter Rainfall Regions, as well as in Venda.

Fasciola spp. (liver fluke) is of increasing importance in the Transvaal Region. It caused problems in Natal, particularly in Griqualand East and along the coast, as well as in the Eastern OFS. Infestations were also found in Venda and the Highveld and Eastern Cape and Karoo Regions.

Paramphistoma spp. infestations were severe in the Eastern Cape and Karoo, Transvaal, OFS (especially the eastern part), Winter Rainfall (especially the Stellenbosch district) and Highveld (especially in winter) Regions.

Dictyocaulus spp. (lung worms) caused problems in Natal and in the Robertson and Montagu districts.

Nematodirus spp. (long-necked bankrupt worm) was troublesome in the Eastern Cape and Karoo and Winter Rainfall Regions (especially in the Calvinia State Veterinary Area).

Ostertagia spp. (brown stomach worm) caused acute mortality in the Eastern Cape in newly weaned Angora kids. It was the commonest internal parasite in the Calvinia State Veterinary Area.

Trichuris ovis (whip worm) caused considerable problems in the Southern OFS, as did *Bunostomum* spp. (hook worm) in Natal.

Tapeworm infestations took their toll in young animals in all the Regions, as well as in Lebowa and Bophuthatswana.

Stilesia hepatica (liver tapeworm) was again responsible for the condemnation of many livers in the OFS, Transvaal and Eastern Transvaal Regions.

Bilharzia was found in the Mokerong district of Lebowa. Cases of *Coenuris cerebralis* ("draaisiekte" or gid) appeared in the OFS, Winter Rainfall and Eastern Cape and Karoo Regions.

Oestrus ovis (nasal worm) infestations were reported from the Eastern Cape and Karoo and Winter Rainfall Regions, and the Vryburg State Veterinary Area. The incidence of measles has decreased notably from 6 per cent to 2,4 per cent in cattle and 2,0 per cent to 1,3 per cent in pigs in the Vryburg State Veterinary Area. The reason for this decline is unknown. The condition was fairly widespread in the Transvaal Region. Measles is becoming a serious problem in parts of the Eastern Transvaal Region. One farm in the Barberton district had more than 50 per cent of carcasses condemned at the abattoir.

The possibility of using radio-active irradiation to render measles-infested pig carcasses suitable for human consumption is being studied by the Veterinary Research Institute. It has been determined that tapeworms obtained from measles that have been irradiated by a cobalt source are infective for hamsters. Their lifespan, however, is reduced and the tapeworms are slowly resorbed. The basic reason for this still has to be determined.

EXTERNAL PARASITES

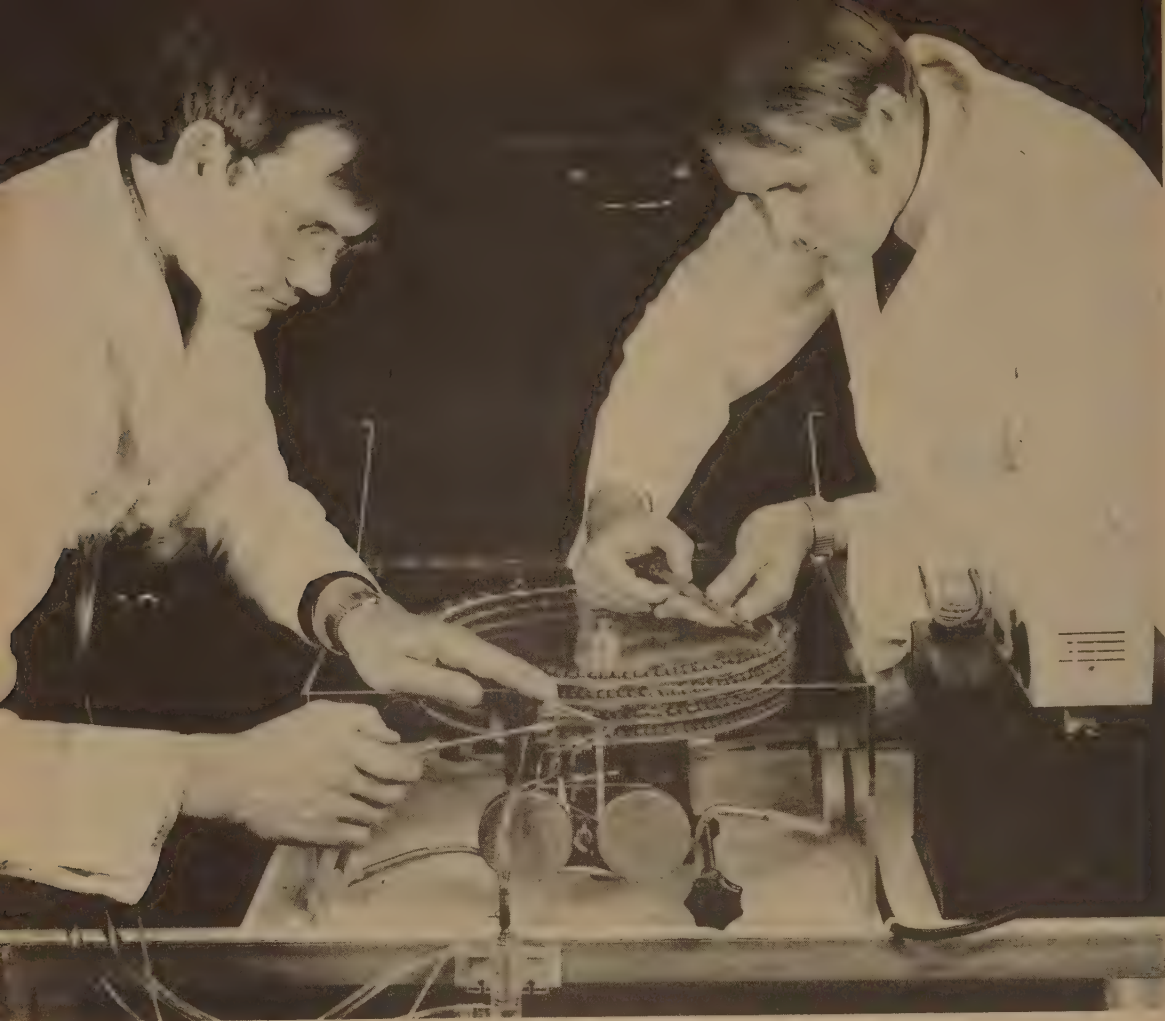
Because of the unusually good rainfall ticks caused serious problems throughout the Republic, except in Natal. Tick-borne disease increased enormously, as did abscesses (particularly *Corynebacterium* abscesses), especially in the OFS Region and the Calvinia State Veterinary Area. The above diseases are also on the increase in the Caledon district.

Amblyomma spp. has spread over the Highveld Region as far west as Vergeleë. Heartwater and consequently *Amblyomma hebraeum* have appeared in Natal in areas where they were previously not recorded, e.g. Glencoe.

Boophilus spp. were present in all the Regions. However, *B. microplus* has not yet been found in the OFS Region.

Rhipicephalus appendiculatus has been found in disturbing numbers in the Pietersburg and Lydenburg State Veterinary Areas and in the Transvaal and Natal Regions. This species is also on the increase in the Winter Rainfall Region.

Ixodes rubicundus (Karoo paralysis tick)



Ticks being injected with a sialogogue. They have been mounted on an apparatus manufactured at Onderstepoort for the purpose of collecting relatively large volumes of tick saliva

caused losses among cattle and sheep in the Central, Eastern and Southern OFS (one farmer lost 100 sheep in three days). This tick was also very active in the Eastern Cape and Karoo and Winter Rainfall Regions.

Rhipicephalus distinctus was found for the first time in the Williston district and identified at Onderstepoort.

Generally speaking the resistance of ticks to the dips in use at present is increasing. In kwaZulu the use of arsenic as a dip was discontinued during the year and replaced by Toxaphene and Delnav DFF with good results.

A continuation of the survey by the Veterinary Research Institute on resistance of the blue tick (*Boophilus decoloratus*) to organic-phosphatic dips showed that the phenomenon is fairly widespread. The ticks collected by the Division of Veterinary Services and submitted to Onderstepoort showed that resistant blue ticks are found in the Louis Trichardt, Potgietersrus, Thabazimbi, Rustenburg, Lydenburg and Piet Retief districts of the

Transvaal, as well as in the Pietermaritzburg and Ixopo districts of Natal. Although the survey is as yet limited in extent, there appears to be no general distribution of resistance in the above-mentioned districts; resistance seems to be limited to certain farms. An investigation was launched to determine the nature of this resistance.

An electronic counter was modified at the Veterinary Research Institute to count tick eggs. This involved the construction of a flow-through detector by means of which all the eggs in a suspension could be counted. In this way the need for a homogenous suspension of the eggs, an essential pre-requisite when counting aliquots, was obviated.

A photo-electric counter for tick larvae was developed and constructed in collaboration with the Electronic Instrumentation Division of the CSIR, and was used in the determination of the percentage hatch of tick eggs treated with chemical and hormonal ixodicides. This investigation has not yet been completed.

For the purposes of the biological and bio-

chemical studies the Veterinary Research Institute intends to undertake on the saliva of various species of ticks, some of which transmit disease or are associated with specific pathoses known as tick toxicoses, it is necessary to collect relatively large volumes of saliva. A mechanical rotating saliva collector which can collect the saliva of 300 to 400 ticks that have been injected with a sialogogue in approximately two hours was perfected during the year under review. Depending upon the tick species and the number of ticks available, up to 4 ml can be collected during this period. A constant temperature of 30 to 32°C and a relative humidity of 90 to 100 per cent can be maintained within the apparatus, and the saliva can be kept at a selected low temperature or even frozen for preservation. Large volumes of saliva have already been collected from four different tick species and are now undergoing biochemical investigation.

Genetic studies on blue ticks

Studies at the Veterinary Research Institute on the chromosomes of South African strains of *Boophilus decoloratus* and *B. microplus* showed that they are identical in number and shape. The females have 22 chromosomes and the males 21 chromosomes. As is the case in other shield ticks, the males are the heterogametic sex. Breeding studies revealed that there must be considerable genetic differences between South African and Australian *B. microplus* ticks. No progeny was obtained when females of an Australian strain were mated with males of various South African strains of *B. microplus*, whereas 60 per cent of the eggs of the females of the reverse cross were fertile. The ticks that hatched were, however, infertile in the adult stage. This incompatibility is an indication of long-standing genetic diversions between Australian and South African *B. microplus*.

Sheep lice infestations were found in Lebowa and Venda, as well as in all the Regions except the Eastern Transvaal.

Problems were caused by *Melophagus ovinus* (sheep ked) in the Highveld, Winter Rainfall (especially in the Laingsburg district) and Eastern Cape and Karoo Regions. This parasite was also found in the Ciskei and Lebowa. The Australian itchmite (*Psorergates ovis*) was encountered in the Eastern Cape and Karoo and Winter Rainfall Regions.

Entomological studies in flooded areas

Abnormally high rainfall in the normally dry North-Western Cape and Southern OFS led to floods and the formation of many pans of water. It is estimated that up to 10 per cent of the surface was under water in some places. Ideal conditions were thereby created for the breeding of blood-sucking insects and mosquitoes which were directly or indirectly responsible for large stock losses caused by the transmission of diseases like Rift Valley fever, bluetongue and Wesselsbron disease.

These losses could have been prevented by prophylactic immunisation.

Direct losses as a result of attacks by very large numbers of mosquitoes occurred among young lambs. The mosquitoes caused acute anaemia and toxicosis.

Tests with specially formulated insecticides against mosquito larvae gave disappointing results, but natural biological control from an unexpected source largely solved the problem. A predatory fly called *Lispe barbipes*, which wrought havoc amongst the larvae, was responsible.

Interesting, as well as potentially valuable, information about the subfamily *Muscinae* (flies) was collected by the Division of Veterinary Services and collated in collaboration with Onderstepoort. Some of the flies collected in these areas transmit *Parafilaria bovicola*, the cause of false bruising in cattle, elsewhere in SA. Although *P. bovicola* is as yet unknown in this area, the parasite could nevertheless establish itself here.

It was also noticed that blood-sucking flies like *Musca crassirostris* and *Stomoxys calcitrans*, feed on cattle at drinking troughs. The former accompany the cattle when they move out to graze, whereas the latter never go further than 300 metres from the troughs. Flies like *M. lusoria* and *M. xanthomelas* will disturb feeding horseflies to feed on the blood exuding from bite wounds.

Simulium spp. appeared in terrific numbers along the Vaal, Harts and Orange Rivers. Swarms were found as much as 50 km away from their normal breeding places. *Chlamydia* organisms and Rift Valley fever virus were isolated from *Simulidae*.

Swollen rivers greatly reduced the rate of multiplication of the midge *Simulium*. Large-scale breeding of *Simulium* in the Orange River below the Boegoeberg Dam resulted in a midge problem in the Prieska - Groblersbrug area. Rift Valley fever was also a problem in this area, in the virtual absence of mosquitoes, and the virus could be isolated from midges collected there. This is the first time that *Simulium* has been incriminated as a possible vector of Rift Valley fever.

The Veterinary Research Institute established that breeding of *Simulium* was taking place in the Vaal River, between Warrenton and Delpportshoop, for the first time since 1966, when the river was treated with DDT. Completion of the Bloemhof and Spitskop Dams is expected to aggravate the midge problem. The value of water manipulation as a control measure will be tested between Bloemhof and Christiana during the coming rainy season. Biting flies were prevalent in the North-Western Cape, Central Orange Free State and the Inanda and Lower Tugela districts in Natal. Eleven species of *Musca* were collected and identified in the Kuruman district. *Haematovosca uniseriata*, *Stomoxys calcitrans* and *Tabanidae* were also collected there.

Twenty-six insecticides were tested under laboratory conditions by the Veterinary Research Institute against laboratory-bred *Stomoxys calcitrans* with the object of finding a preparation with a prolonged residual effect for use in the field. Five of these insecticides killed 100 per cent of the flies at

The mouth-parts of the fly *Musca lusoria* which is infested with larvae of the worm *Parafilaria bovicola*, the cause of false bruising in cattle



prescribed concentrations. Even at a concentration of one part per million they still killed from 5 to 30 per cent of the flies, indicating that they might have a residual action. Critical tests are being conducted at present to determine whether they show this effect under natural conditions.

Because the climate was favourable, **blowflies** were a source of great irritation to sheep in the Eastern Cape and Karoo Region. Infestations also occurred among sheep at Laingsburg. Blowflies did not cause serious problems in the rest of the country.

Parafilaria bovicola infestation in cattle was prevalent in the bushveld parts of the Transvaal. Sixty per cent of the animals were affected in a herd at Barberton. Cattle from a feedlot at Rustenburg showed a 90 per cent infection at the abattoir.

The research work on *Parafilaria bovicola* mentioned in the previous report was continued by the Veterinary Research Institute. Surveys showed that, in addition to the entire bushveld and lowveld areas of the Transvaal and the northern parts of SWA, most of kwaZulu, parts of the Estcourt district and the Eastern Cape near Stutterheim and Sterkstroom were also infested. At the Mara Research Station it was determined that the percentage of oxen showing bleeding as a result of infestation with this parasite was twice as high as that of heifers. The highest incidence of bleeding occurred in bulls and the lowest in cows. It would appear, therefore, that hormones influence the susceptibility of animals. Bleeding reached a peak in October in all sex groups. Bleeding decreased rapidly from January onwards, except in bulls, many of which still showed evidence of bleeding in February.

The three *Musca* spp. - *M. lusoria*, *M. xanthomelas* and a new *Musca* sp. - that were identified as vectors of *P. bovicola* last year were again found to be infested. At the Soutpan Research Station 5,5 per cent of the new *Musca* species, which was the commonest species present, were infested. Infested flies were collected until May 1975.

The examination of carcasses of 1½ to 2½-year-old oxen from Mara produced incidence

figures of 33 per cent in April and 77 per cent in June.

Successful artificial infestation of cattle with third-stage larvae of *P. bovicola* was recorded.

Only two of the eight drugs tested against *P. bovicola* in experiments at Soutpan showed promising results; these were levamisole and fenbendazole. The treated oxen were examined both before and after slaughter. It was observed that there was a considerable decrease in the number of bleeding spots on the live animals as well as in the number of lesions in the carcass. Extremely large doses of these drugs must, however, be administered - a consideration which makes treatment expensive in practice.

Demodex spp. infestation was reported in dogs in Venda and Lebowa.

Hypoderma bovis larvae were again found in cattle at the Jan Smuts quarantine station. Routine treatment of animals from infected countries is carried out there. No living larvae have been found outside the quarantine station.

BASIC VETERINARY RESEARCH

Ruminant digestion

Research workers at the Veterinary Research Institute at Onderstepoort have established that the level of biuretolytic activity of rumen samples obtained through conventional 15 mm diameter sampling tubes is four to five times below the normal values. This is because the biuretolytic bacteria are associated with the solid particles of ruminal ingesta which are strained off by a plug of particles formed at the base of the sampling tubes.

Large cannulae (83 mm in diameter) were therefore used to sample ingesta in studies on sheep receiving a ration containing biuret for the first time. It was observed that levels of activity two to four times as high as those required to break down a practical ration of biuret developed within a week. Moreover, a satisfactory level of activity, enabling sheep to re-adapt almost immediately, was

maintained by intermittent feeding of biuret, even if the time interval was as long as 6 months.

The microbiological and biochemical adaptational changes that take place when sheep are gradually switched (i.e. on a weekly basis, over a period of four weeks) from a high maize stalk (roughage) to a high maize grain (concentrate) ration were studied. Adaptation was successful in the sense that, although lactic acid levels rose transiently, none of the animals developed acute acidosis as a result of high lactic acid levels. The total number of culturable rumen bacteria rose tenfold with the increase in concentrates, reaching the peak count seven days after the change to the final high concentrate diet. Amylolytic, lactolytic and cellulolytic bacteria accounted for this increase in 50 per cent of the sheep. In the others cellulolytic bacteria tended to fall, probably on account of the low ruminal pH (5.4 to 5.8) of these animals. The increase in lactic acid utilising bacteria explains the rapid decline in ruminal lactic acid. Ciliated protozoa generally increased fivefold to tenfold, reaching a peak one day after the final change in diet. Only where the pH fell below the critical 5.5 level did the protozoa decrease in number.

MISCELLANEOUS RESEARCH AND PROJECTS

Officers of the Division of Veterinary Services registered ten new projects during the year under review, and work on two research projects and ten projects were concluded.

Research on game and diseases of game

This was continued in the Kruger National Park.

Linguatula and *Armillifer* spp. were collected from 9 species of game. Impala were artificially infected with parasites collected from a lion.

The possibility of artificially inseminating cheetah is still being investigated by officers of the Division of Veterinary Services at Skukuza.

Because game farming is becoming increasingly important, some anthelmintics were tested on certain species of game for toxicity and efficacy. Some of these were found to be safe for blue wildebeest (gnu) even at dosages of up to four times the recommended dose.

Lions, leopards, cheetahs, impala, blue wildebeest (gnu), buffaloes and giraffes were found to be infected with mange.

Notoedres cati was the parasite which caused most of the cases in leopards in the Skukuza area. Lions, leopards and cheetah recovered after treatment. Carnivores appear to be more severely affected than other types of animals.

During the year it was established that seven game species are natural hosts of *Echinococcus* spp. Nearly 60 per cent of the zebra in the Kruger National Park are infected and lions become re-infected by feeding on the zebra.

In an investigation to determine the incidence

of bilharzia among wild animals, 14 species were found to be infected with the parasite. This project was undertaken in co-operation with the South African Medical Research Council and the National Parks Board.

It was found that the eland is susceptible to heartwater, chlamydiosis, cytauxzoonosis and coriphilosis.

In co-operation with the Faculty of Veterinary Science of the University of Pretoria, attention was given to the genetic and geographic distribution of game populations and the diseases spread by them. As part of this the genetic pattern of elephants and buffaloes was investigated in order to determine their ability to spread horsesickness and foot-and-mouth disease.

Antibodies against infectious bovine rhinotracheitis and infectious pustular vaginitis of cattle were found in blue wildebeest (gnu).

A lesion caused by a *Mycobacterium* sp. was found in the lung of an elephant for the first time.

A severe skin condition which occurred in roan and sable antelope kept in a special enclosure in the Kruger National Park was ascribed by the Veterinary Research Institute to infection with *Dermatophilus congolensis*, the cause of a disease known as Senkobo disease, streptothricosis or dermatophilosis of cattle. This is the first report of dermatophilosis in antelope in southern Africa. A single injection of long-acting penicillin and streptomycin, administered under anaesthesia, combined with topical treatment, cured the disease.

VACCINE PRODUCTION

Once again the year 1974/75 was a record year for vaccine production for the Veterinary Research Institute at Onderstepoort. The total production for 40 vaccines amounted to 170 696 304 doses, compared with 152 509 615 during the previous year - an increase of almost 12 per cent.

Of the total production, 14 430 758 doses were supplied to foreign countries - predominantly African states. The total income from the sale of vaccine for the financial year 1974/75 was R1 449 593,00.

This production was achieved under considerable pressure since the expansion of facilities and staff needed to produce these quantities of vaccine could not be obtained. The problems were accentuated by periodic shortages of various basic materials and medium components imported from overseas.

The increase in the number of doses of vaccine issued during this year was primarily due to a tremendous increase in the demand for vaccines against Rift Valley fever, Wesselsbron disease, enzootic abortion in sheep, lam dysentery and infectious laryngotracheitis in poultry.

In addition to the expansion in routine production, four new vaccines were made available to farmers.

As a result of the particularly good summer rains and the consequent abundance of mosquitoes during the first three months of 1975, an extremely

extensive outbreak of Rift Valley fever was experienced. The disease was particularly prevalent in cattle, so that the production of an inactivated vaccine became urgent. A major effort was made to meet this demand and, despite considerable technical problems, a total of 1 007 200 doses was produced and issued at very short notice. In order to expedite distribution and administration, the vaccine was initially dispatched in bulk consignment to State veterinarians, and issued to farmers free of charge. The vaccine is at present being sold direct to the public.

A *Vibrio fetus* vaccine was also released during the year under review. As in the case of inactivated Rift Valley fever vaccine, production is being hampered by technical difficulties, but production is keeping abreast of the demand at present and 13 100 doses have already been issued. Extensive use of this vaccine should contribute materially to a considerable increase in the national calf crop.

Another long-awaited and urgently required product, namely ephemeral fever vaccine, has also been released. It should be a great boon to stud and dairy farmers and, although only 50 899 doses have been sold to date, the demand is expected to increase during the spring and summer of 1975.

Infectious laryngotracheitis vaccine has been issued to State veterinarians for some time, but it was considered expedient to release it to the public as well, particularly for the benefit of the large poultry enterprises in the South-Western Cape. To date 9 111 000 doses have been sold.

Mainly because of injudicious use by farmers, problems were encountered with local reactions after the injection of the oil-emulsion enterotoxaemia vaccine. It was therefore decided to reintroduce the old alum-precipitated enterotoxaemia vaccine. To date 669 700 doses of this vaccine have been sold.

The number of strains included in the horse-sickness vaccine has been increased to six. It now also contains Type 4, which was issued as a monovalent vaccine the previous year.

Many vaccines are still in the experimental stage, and numerous doses of these were issued to State veterinarians for field trials. These include *Clostridium septicum* (40 150 doses), *Vibrio fetus* (39 510 doses), infectious coryza (120 000 doses), inactivated paratyphoid vaccine (2 250 doses) and infectious bovine rhinotracheitis vaccine (2 700 doses). The *Vibrio fetus* and infectious coryza vaccines have already been released, and it is anticipated that the others will follow shortly.

Some special vaccines were also prepared for specific purposes. These included vaccines against *Pasteurella* (100 750 doses), *E. coli* (2 380 doses) and *Staphylococcus* (8 356 doses).

A vaccine against foot-rot of sheep *Fusiformis nodosus* and a *Staphylococcus* vaccine for cattle, as well as an oil emulsion Newcastle disease vaccine, are in the early stages of development. Experiments are also being conducted with the purpose of producing a combined quarter evil - botulism vaccine for cattle, and a combined *Clostridium* vaccine for sheep.

A list of the vaccines and diagnostic reagents, and the number of doses of each which were sold by the Veterinary Research Institute from 1 July 1974 to 30 June 1975 appears on the following page.

The following vaccines were produced by State veterinarians in the field:

Heartwater - 9 222 doses
Autogenous wart - 2 170 doses
Orf - 5 965 doses

Staphylococcus aureus (dogs) - 200 ml (experimental vaccine).

Altogether 76 500 ml of leptospirosis antigen was prepared by the regional veterinary laboratory at Stellenbosch.

At Middelburg (Cape) 762 ml of *Actinobacillus seminis* antigen, 748 ml of complement and 631 ml of *Pasteurella haemolytica* experimental vaccine were produced.

During the year under review 38 732 doses of various vaccines valued at R509 were destroyed because the expiry dates had been reached.

DIAGNOSTIC SERVICES

A more comprehensive study of the health conditions of the colony of laboratory animals at Onderstepoort was initiated at the Veterinary Research Institute this year. *Post-mortem* examinations and histopathological and other investigations have revealed that *Salmonella* was the most important cause of death in mice and guinea pigs; chlamydiosis was established as the cause of death in the majority of rabbits. It is possible, however, that nosematosis and coccidiosis, which are very frequently found in rabbits, contributed to mortality. Acute pneumonia and mastitis, which were apparently caused, respectively, by a haemolytic *Streptococcus* and *Staphylococcus aureus*, were also important causes of mortality in guinea pigs.

During the past year 266 194 mice, 11 291 guinea pigs, 1 211 rabbits, 1 281 rats, 1 445 hamsters and 50 ferrets were bred. In the same period 180 990 mice, 8 712 guinea pigs, 1 313 rabbits, 207 rats, 528 hamsters and 86 ferrets were used for experimental purposes and for the production of vaccine.

The revised regulations for fees payable for laboratory tests were published during the year and the new fees have been charged for services rendered.

Post-mortem examinations were carried out for diagnostic purposes on a total of 5 408 cattle, sheep, goats, pigs, equines, dogs, cats and other animals by State veterinarians of the Division of Veterinary Services; 1 824 examinations were carried out at the Veterinary Research Institute.

State veterinarians of the Division of Veterinary Services did 14 573 poultry *post-mortem* examinations; 5 302 were done at the Veterinary Research Institute.

The following laboratory tests were carried

Bacterial vaccines	1972/73	1973/74	1974/75
Enterotoxaemia (oil adjuvant)	-	-	33 840 520
Enterotoxaemia (alum-precipitated toxoid)	-	-	669 700
Enterotoxaemia (total)	31 512 900	39 357 500	34 510 220
Lamb dysentery	228 250	409 870	2 414 100
Brucella (cattle)	1 679 465	1 889 999	2 366 269
Brucella (sheep)	407 450	514 300	581 860
<i>Corynebacterium ovis</i>	44 680	156 520	117 000
<i>Corynebacterium pyogenes</i>	249 960	348 180	374 460
Swelled heads in rams	29 150	23 270	63 320
Colibacillosis (cattle and sheep)	14 200	41 570	61 910
Colibacillosis (pigs)	7 800	74 930	86 600
Enzootic abortion (sheep)	156 300	2 164 200	5 002 100
Fowl typhoid	1 864 500	2 469 100	2 224 848
Botulism	4 188 297	5 363 070	4 984 580
Leptospirosis	2 740	1 710	4
Bovine pleuropneumonia	436 280	575 360	716 640
Anthrax	10 445 640	15 936 950	16 520 100
Paratyphoid (live vaccine)(calves)	314 484	364 656	369 022
Pasteurella	682 700	1 039 220	1 371 080
Black quarter	5 080 916	7 257 052	7 333 068
Tetanus	82 460	195 850	131 490
<i>Vibrio fetus</i>	-	-	13 100
<i>Haemophilus gallinarum</i>	-	-	10 000
Total for bacterial vaccines	57 410 172	78 183 307	79 251 771
Virus vaccines	1972/73	1973/74	1974/75
Bluetongue	11 663 700	25 366 550	18 866 100
Pigeon pox	797 200	1 200 000	569 600
Fowl pox	7 913 600	4 429 800	3 095 700
Distemper	28 286	31 965	30 827
Rabies (LEP for dogs)	247 937	165 289	209 866
Rabies (HEP for cats)	16 956	17 279	32 704
Infectious bronchitis (poultry)	4 202 400	2 291 000	2 251 000
Infectious laryngotracheitis (poultry)	-	1 200 000	9 111 000
Lumpy skin disease	371 176	744 977	420 991
Newcastle disease (poultry)(Komarov)	56 550 500	37 481 600	36 557 400
Horsesickness	142 199	184 861	191 265
Monovalent Type 4 horsesickness	-	137 400	35 224
Rift Valley fever (live vaccine)(sheep)	18 896	601 600	12 183 700
Rift Valley fever (inactivated vaccine)(cattle)	-	-	1 007 200
Wesselsbron disease	23 650	148 570	595 450
Ephemeral fever (three day stiffness)	-	-	50 890
Total for virus vaccines	81 976 500	73 554 891	90 568 017
Protozoal and rickettsial vaccines	1972/73	1973/74	1974/75
Anaplasmosis (gallsickness)	381 057	524 923	595 844
Heartwater blood	59 402	78 377	94 648
Rédwater	64 155	106 972	95 914
Elephant skin disease (besnoitiosis)	-	61 145	89 840
Total for protozoal and rickettsial vaccines	504 614	771 417	876 246
Grand total for all vaccines	139 891 286	152 509 615	170 696 034
Diagnostic aids (antigens): number of units	1972/73	1973/74	1974/75
BWD antigen	43 790	54 740	31 980
<i>Brucella abortus</i> antigen	9 800	29 200	32 820
<i>Brucella</i> ring test antigen	320	621	558
Mallein	10	120	-
Tuberculin (bovine)	755 170	642 900	759 420
Tuberculin (avian)	313 700	199 102	290 620
<i>Mycoplasma gallisepticum</i> (CRD) antigen	-	-	134 700
Total for diagnostic antigens	1 122 790	926 683	1 250 098

out at the Veterinary Research Institute, the regional veterinary laboratories and State veterinary offices:

	Division	Research Institute	PPLO tests	19 228	-
			Vibriosis	848	4 840
			Trichomoniasis	238	1 042
			Johne's disease	-	211
<i>Brucella</i> agglutination tests	66 662	25 664	Leptospirosis	1 835	944
<i>Brucella</i> milk ring tests	211	-	<i>Actinobacillus seminis</i>	32 300	-
FA tests	1 137	-	Pasteurellosis	456	-

	Division	Research Institute
Chlamydiosis	203	5 093
Dourine	-	1 603
Rabies	-	958
Antibiograms	602	128
Skin scrapings	2 492	-
Faeces examinations	7 173	252
Identification of internal parasites	2 589	1 926
Mastitis milk examinations	6 828	5 933
Semen	5 345	-
Sheath washings	1 045	-
Aborted foetuses	-	956
Haematology	26 354	-
Biochemical	43 891	4 655
Toxicological	740	-
Feed analyses	-	80
Bacteriological	60 265	4 661
Virological	6 756	1 647
Protozoological	12	-
Biological	92	-
Serotyping of cultures	-	5 795
Histopathological	1 990	4 179
Poultry specimens	-	13 328
Trichinella	200 293	-
Abattoir by-products	-	120
Smears	15 631	175
Ascheim Zondek tests	231	-
Identification of insects and ticks	7	4 565
Clinical examination of animals	90 306	-
Total	595 760	88 755

SURVEYS

Surveys were undertaken at Messina and Pilgrim's Rest to determine the fertility of cattle herds under extensive conditions. At Messina 70 per cent of the cows examined were pregnant and at Pilgrim's Rest the figure was 60 per cent.

A survey to determine the efficacy of BHC powder in controlling the hut tampan (*Ornithodoros moubata*), a carrier of swine fever, was done in the Potgietersrus State Veterinary Area.

The Stellenbosch regional veterinary laboratory conducted a survey on the incidence of mastitis in certain selected dairy herds. With the assistance of stock inspectors the laboratory is also doing a survey on the distribution and effect of chlamydiosis in the Winter Rainfall Region.

A survey to establish the extent of infestation and the importance of internal parasites in stock in Venda has been started.

CLINICAL SERVICES

When their official duties allow it, State veterinarians provide farmers with clinical services, especially in the areas where there are no private veterinary practitioners. Veterinary services are rendered to all State-owned herds and flocks. During the year R24 069,00 was collected for professional services, R5 488,00 for transport charges and R14 062,00 for vaccines sold by State veterinary offices. Laboratory fees amounted to R13 286,00, fees for meat inspection at export abattoirs to R157 918,00, quarantine station fees (animals and

birds) to R152 047,00 and miscellaneous revenue to R2 330,00. The total amount of revenue received by the Division was R369 200,00.

ARTIFICIAL INSEMINATION

The testing of bulls at AI co-operatives and individual breeders is done by the regional veterinary laboratories at Allerton (for Natal) and Stellenbosch (for the Western Cape). The rest of the bulls are tested by the AI and Reproduction Section of the Division of Veterinary Services. The final recommendation for registration or re-registration of all bulls is still made by the AI and Reproduction Section after all results have been made available to, and analysed by, them. A total of 132 bulls were tested for registration or re-registration during the year under review.

Progeny testing showed that 8 bulls had transmitted a meaningful improvement to their offspring.

A bull imported for AI purposes was found to be infected with vibriosis. It was treated and registered after three negative sheath washings. Another bull was serologically positive for brucellosis and also developed a phlebitis in the quarantine stable. Registration of this bull was not recommended. Tests for the infectious pustular vaginitis virus on semen were discontinued during the year. Serological tests are now done and 14 bulls reacted positively.

The total number of semen doses sold by AI co-operatives during 1974 was approximately 426 000 (1973, 328 000). These were responsible for 6,6 per cent of all calves born in 1974 (1973, 5 per cent).

At present semen of 17 cattle breeds is available at AI co-operatives. Of a total of 132 bulls, 70 (53 per cent) are Frieslands. An AI station introduced Bonsmara and Drakensberger bulls for the first time during the year.

From 1963 to 1974 the number of inseminations carried out by registered inseminators decreased by 63 per cent, to 16 558. The majority of farmers do their own inseminations or use non-registered inseminators in their employ.

During the year under review the AI and Reproduction Section of the Division of Veterinary Services offered three courses for persons wishing to become registered inseminators. Only one candidate failed out of 51.

To prevent unnecessary travelling, it was decided to stop holding courses on farms for Non-White labourers who inseminate their own cattle or those of their employers. An experimental course at which various ethnic groups were present was held at Onderstepoort. All 17 who attended the course passed but because of language problems it was decided to restrict future courses to members of the same language group.

The Section also held a course at Middelburg (Cape) and 16 of the 21 candidates passed.

All animal husbandry students at agricultural colleges following a course in veterinary science are

instructed in the different methods of doing artificial insemination.

At Cedara the State Veterinarian of Pietermaritzburg presented 2 courses of a week each to farmers who wished to inseminate their own cattle. The State Veterinarian of Bloemfontein conducted one course on the insemination of cattle and one on the insemination of sheep, for 31 farmers.

At Potchefstroom 18 courses were held for 360 farmers. Seventeen were for cattle farmers and one for sheep farmers. These farmers can now inseminate their own animals. The intention is to allow persons who have completed the course at Potchefstroom and passed the examination to register as inseminators in the same way as those who attend the official courses at Onderstepoort.

HEALTH SCHEMES

Bacillary White Diarrhoea (BWD) and Fowl Typhoid (FT) Scheme

The scheme was discontinued on 8 April 1975. No official testing for BWD/FT-free certificates will be done in future. Particulars of tests carried out and certificates issued during the year (up to and including 8 April 1975) are as indicated in Table A.

PPLO Scheme

This scheme was also discontinued on 8 April 1975. Particulars of tests up to and including 8 April 1975 are as indicated in Table B.

Pig Recording and Health Scheme

Inspections in terms of this scheme were done by veterinarians employed by the Meat Board; the Division of Veterinary Services merely receives copies of reports on such inspections.

TABLE A

Region	Flocks tested	Positive	Suspected	Total tested	Number of certificate holders	Number of fowls
Winter Rainfall	24	-	-	152 927	24	787 509
Transvaal	37	-	-	274 624	37	832 514
Highveld	8	-	-	55 612	9	451 275
Eastern Transvaal	1	-	-	2 591	1	2 591
Total	70	-	-	485 754	71	2 073 889

TABLE B

Region	Total tested	Positive	Suspected	Non-specific	Certificate holders
Winter Rainfall	11 492	1 859	29	74	3
Transvaal	6 750	500	-	-	1
Highveld	2 746	244	-	-	3
Total	20 988	2 603	29	74	7

MEAT HYGIENE

Abattoirs

The Division of Veterinary Services has on record 1 112 abattoirs, comprising 921 red meat abattoirs, 163 poultry abattoirs and 28 rabbit abattoirs. The increase in poultry abattoirs can be attributed to the fact that farmers' wives who keep poultry as a home industry are now required to register their slaughtering-place as an abattoir.

The provincial distribution of these abattoirs is: Transvaal 353, Cape 361, Natal 137, Orange Free State 70. The above-mentioned figures include all abattoirs in the homelands, with the exception of the Transkei.

During the year under review the following 90 abattoirs closed down for various reasons and their certificates of approval were cancelled: Transvaal 17, Cape 39, Natal 32 and Orange Free State 2.

The Division of Veterinary Services is now clamping down on unhygienic abattoirs and a number of owners have been prosecuted.

The subsidy paid in respect of the salary of meat inspectors employed by local authorities during the year amounted to R177 716,00.

Sterilisation installations

Forty-five out of a total of 71 sterilisation installations were re-registered; the registration of four was refused because of inadequate facilities. One new installation was added to the above-mentioned total during the year under review.

During the year the continuous method of rendering carcass material was firmly established. Although this method is in certain respects inferior to the ordinary batch rendering system it offers advantages far superior to those of the batch system.

Planning

The Division has in terms of section 18 of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), again examined 99 plans and drawings of abattoirs and factories submitted for consideration and advice. Fifty-five were for new abattoirs and the remaining 44 were proposed improvements to existing establishments.

The planning of red meat abattoirs outside the Transkei and the other homelands took place in close collaboration with the Abattoir Commission.

Meat imports

South Africa is still importing meat from Rhodesia, Botswana and Swaziland.

Meat exports

Exports have been at a very low level during the current year. Pork was the main type of meat exported but even here quantities were very small.

The chief importers of meat and meat products were various islands in the Indian Ocean, Hong Kong, the United Kingdom, Persian Gulf countries and various "free ports" in Europe.

During the year conditions at one abattoir and one deboning and processing establishment were found to be below the standards required for export to the EEC countries and since these shortcomings were not rectified, this deboning and processing establishment was removed from the list of premises approved for export to these countries.

Two more establishments were found to comply with the requirements for exporting to the United Kingdom and were added to the approved list. At the end of the year under review there were 12 approved plants for export to one or more of the EEC countries and this number is expected to increase during the coming year when new abattoirs are completed.

Meat inspection and control services

The Division provides meat inspection services at the following establishments owned and operated by the Abattoir Commission: the abattoirs at Newtown, Germiston, Springs, Benoni, Pietermaritzburg, Pretoria and Wynberg.

Similar services were rendered at the following private abattoirs: Impala Union, Otavi; African Meat Cannery, Okahandja; Damara Meat Packers, Windhoek; Spekenam, Bellville; Eskort Bacon Co-op, Heidelberg, Transvaal; Eskort Bacon Co-op, Estcourt, Natal, and Balfour Meat Corporation, Balfour.

A supervisory service is also provided at the following export establishments: Orchid Foods, Durban; Siegel Meat Industries, Krugersdorp; Braams Meat Purveyors, Cape Town; Table Bay Cold Storage, Cape Town and Brixton Wholesale Meat Supplies, Sandton.

Centralisation of abattoirs

The Division has been very closely concerned with the abattoir rationalisation schemes of the Abattoir Commission. In areas where such schemes were considered or are under consideration, the Division has not insisted on costly structural improvements to abattoirs. Indeed, where abattoirs applied for exemption from remedying defects, such exemption was granted. In areas where the idea of centralisation has been abandoned, e.g. in the Orange Free State, abattoir owners were, however, required to bring their facilities up to the required standard.

The Division has also been urging owners of poor and uneconomic facilities to close down such abattoirs and to obtain their meat supplies from an alternative source. This policy was mainly responsible for the closing down of 90 abattoirs during the year under review. The Division will continue to follow this policy in future.

Cattle tripe sometimes contains bacteria and other micro-organisms that are harmful to human beings. Research at the Veterinary Research Institute has shown that tripe consisting of the paunch and intestinal canal can be converted into an acceptable preserved product by a process of washing, followed by mincing and preserving.

The fresh product is, however, a much more difficult proposition. The only thing that inhibited potentially pathogenic organisms was washing, followed by storage at 4°C and the lowering of the pH to 4 by means of acetic acid at a temperature of 30°C. It was also found that the quality of dubious samples could be determined with the aid of bacteria counts. Well-prepared, fresh tripe had maximum counts of 1×10^6 bacteria, but badly handled material had higher counts.

STOCK INSPECTION SERVICES

Notwithstanding an ever increasing shortage of stock inspectors, attempts are still made to provide an effective and functional stock inspection service for farmers. What renders the position still more disturbing is the fact that 48 per cent of the inspectorate staff are older than 50 years. It is still extremely difficult to obtain suitable candidates to fill the vacancies.

It appears that the in-service training of stock inspectors is bearing fruit as they are now in a position to increase the scope of the service they provide, especially with regard to extension to farmers.

ANIMAL HEALTH EXTENSION SERVICE

Extension services rendered to farmers by officers of the Division of Veterinary Services are expanding all the time. Group extension programmes include the following: short courses on the prevention and control of animal diseases; lectures at farmers' days; active participation in study groups; demonstrations on individual farms and the

compiling and distribution of vaccination and dosing programmes. Leaflets were written for distribution by the Division of Agricultural Information. A brochure on the functions and aims of the Division of Veterinary Services and a manual on the bovine tuberculosis scheme were also made available for general use.

State veterinarians and the inspectorate staff provided individual extension for farmers with specific problems during farm visits, office interviews, by telephone or by letter. Stock inspectors are playing an increasingly important part here.

IMPORT CONTROL

One of the major functions of the Division of Veterinary Services is to guard against the introduction of animal diseases from other countries. To this end quarantine facilities are made available at the Jan Smuts Airport, Durban, Cape Town and Walvis Bay quarantine stations.

There are facilities for a wide variety of animals, as is evident from the following table of animals imported for slaughter, farming or other purposes:

Cattle	12 143
Horses	349
Sheep	313
Goats	127
Pigs	109
Dogs	2 328
Cats	779
Poultry	11 800
Birds	75 765
Rabbits	34
Tropical fish	1 490 982
Tropical fish eggs	305 000
Zoo animals	10 006
Primates	472
Reptiles	476
Rodents	1 147
Insects	642

The following table gives an indication of the products imported into the Republic under permits issued by the Division of Veterinary Services:

Biltong	1 627 kg
Frozen meat	8 357 050 kg
	500 sides
	237 train truckloads
Cattle offal	32 524 kg
	45 cartons
Sheep offal	8 611 kg
Poultry carcasses	10 000 units
Ham	500 kg
Tallow	17 246 kg
Lard	53 636 kg
Sausage casings	935 194 kg
	483 drums
	40 bundles
Salami	23 886 kg
Cream	175 655 litres
Molten butter	884 kg
Hides and skins	31 519 254 kg
	54 896 units
	2 431 bundles
	200 000 units
Wet salted hides	
Undyed wool tops	1 000 units
Rabbit fur	3 774 kg
Karakul pelts	12 607 units

Wool	861 974 kg
	19 bales
Mohair	1 908 kg
Hair and bristles	130 375 kg
Feathers	14 486 kg
Horns	10 000 kg
Bones	10 000 kg
Bonemeal	665 272 kg
Carcase meal	770 000 kg
Blood meal	214 000 kg
Casein	581 507 kg
	450 packets
Stock feed	591 980 kg
Processed skins and trophies	28 units
Veterinary vaccines	826 916 370 doses
Veterinary antigens	8 140 ml
Veterinary remedies	19 133 kg
Gonadotropins	13 350 000 units
Pregnant mare serum	3 000 units
Semen	3 061 doses
Cattle and sheep kidneys	26 944 kg
Bull testes	35 904 kg
Second-hand bags	242 339 kg
	7 485 units

EXPORT CONTROL

In accordance with the requirements of importing countries, veterinary examinations for export purposes were carried out on the following animals, and certificates were issued:

Cattle	4 743
Equines	530
Sheep	1 448
Goats	146
Pigs	92
Dogs	1 452
Cats	201
Poultry	648 602
Birds	2 568
Rabbits	32
Wild animals	144
Laboratory animals	9
Seals	7
Reptiles	239
Fish	40

The following products were certified for export:

Biltong	550 kg
Chilled and frozen beef	145 833 kg
Canned beef	940 362 kg
Frozen ox liver	1 404 kg
Beef extract	32 125 kg
Frozen and chilled mutton	1 370 kg
Frozen and chilled pork	3 713 100 kg
Pork sausages	1 100 kg
Smoked ham	122 kg
Tinned bacon	4 000 kg
Lard	4 997 kg
Polony	900 kg
Poultry meat	23 736 kg
	1 536 cartons
	29 820 units
Canned fish	4 364 983 kg
Sausage casings	10 214 kg
	92 drums
Whale meat	612 435 kg
Eggs	700 dozen
Ostrich eggs	34 kg
	70 units

Hides and skins	32 942 116 kg
	16 854 bales
	2 bags
	7 units
Karakul pelts	1 277 540 units
Wool	43 653 872 kg
	29 331 bales
	13 samples
Mohair	1 265 819 kg
Hair and bristles	5 159 kg
Ostrich feathers	64 235 kg
	27 boxes
Ostrich skins	409 units
Hooves and horns	92 868 kg
	2 027 bags
Rennet	240 kg
Ox gall	625 drums
Lamb paunches	11 148 kg
Blood meal	5 015 219 kg
Carcass meal	105 000 kg
Fishmeal	17 337 408 kg
Whale protein meal	5 854 586 kg
Molasses meal	4 951 000 kg
Oilcake meal	285 000 kg
Ostrich eggshells	1 129 kg
Poultry feed	7 975 410 kg
Cattle feed	17 295 475 kg
	2 000 bags
Pet food	13 000 kg
Teff	29 000 kg
Processed skins and trophies	2 471 units
Elephant skin	566 kg
Grain	1 052 332 000 kg
	100 bags
Cotton seed	13 632 000 kg
Lupin seed	150 kg
Beans	2 550 kg
	1 000 bags
Sweet corn	500 kg
Potatoes	4 684 kg
Onions	50 000 kg
Vegetable seed	300 kg
Grapes	25 550 621 kg
Salt	63 750 kg

TRAINING

State veterinarians were again responsible for the veterinary science courses at all the agricultural colleges.

Various State veterinarians attended refresher courses at Onderstepoort on microbiology, reproduction, diagnosis of fertility problems and laboratory techniques.

The formal in-service training of the stock inspectorate staff proceeded. During the year 129 officers were trained by means of 4 courses. The total number trained since 1972 is now 388. The service of officers trained in this way are far more valuable since they can now assist farmers with a variety of matters, e.g. advice on vaccines and their uses, first aid to animals in emergencies, the correct method of taking specimens for laboratory examination and simple veterinary practices such as de-horning, castration, tail docking of lambs, etc.

LEGISLATION

During the year, the following Government Notices were published under the Acts indicated:

Animal Diseases and Parasites Act, 1956 (Act 13 of 1956)

- (a) *GN R. 1924 dated 25 October 1974* - Regulations promulgated in terms of the Animal Diseases and Parasites Act, 1956 (Act 13 of 1956)
- (b) *GN R.442 dated 7 March 1975* - Amendment of Standing Regulations
- (c) *GN R.1389 dated 25 July 1975* - Amendment of Standing Regulations
- (d) *Proclamation R.208 of 1974* by the State President of the Republic of South Africa, published in Government Gazette 4462, dated 25 October 1974 - Commencement of the Animal Diseases and Parasites Amendment Act, 1973
- (e) *Notice 484 of 1974 (for general information)*, published in Government Gazette 4347, dated 2 August 1974, by the Secretary for Agricultural Technical Services - Conditions and fees for the rendering of certain veterinary services to the public

Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967)

- (a) *GN R.1925 dated 25 October 1974* - Standing Regulations under the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967) - Amendment
- (b) *GN R.1926 dated 25 October 1974* - Exclusion of certain areas where animals are slaughtered from the provisions of the Act
- (c) *GN R.1927 dated 25 October 1974* - Exclusion of certain classes of animals from the provisions of the Act
- (d) *General Notice 491 of 1974* published in Government Gazette 4353, dated 9 August 1974, by the Chief Meat Hygiene Officer - The granting of exemptions under the Act to certain abattoir owners/operators
- (e) *General Notice 406 of 1975* published in Government Gazette 4767, dated 27 June 1975, by the Chief Meat Hygiene Officer - General exemption in respect of conveyances of meat
- (f) *General Notice 407 of 1975* published in Government Gazette 4767, dated 27 June 1975, by the Chief Meat Hygiene Officer - The granting of exemption in general for the use of polyvinyl chloride film which is thinner than 125 gauge
- (g) *General Notice 408 of 1975* published in Government Gazette 4767, dated 27 June 1975, by the Chief Meat Hygiene Officer - The granting of exemptions under the Act to certain abattoir owners/operators
- (h) *Notice 599, dated 27 March 1975* by the Department of the Prime Minister for general information - Act 13 of 1975: Animal Slaughter, Meat and Animal Products Hygiene Amendment Act, 1975.

STOCK CENSUS

Region or Homeland	Cattle*	Sheep		Goats	Horses	Donkeys and Mules	Pigs	Fowls	Dogs
		Woolled	Non-woolled						
Winter Rainfall	335 981	2 850 069	1 367 579	357 986	18 046	8 211	162 088	10 342 234	42 924
Eastern Cape and Karoo	880 852	7 133 758	1 509 774	1 188 721	30 261	11 225	80 622	2 579 235	69 859
Transvaal	2 135 658	2 639 427	273 634	101 214	42 877	9 725	254 472	10 056 222	344 478
Natal	1 531 766	1 053 810	90 918	133 927	32 521	6 764	146 441	13 539 131	70 027
OFS	1 239 935	2 981 385	3 262 189	489 024	40 317	17 918	100 975	818 302	51 724
Highveld	2 077 756	2 349 575	367 855	70 978	56 800	5 090	237 571	3 628 587	142 472
Eastern Transvaal	1 229 785	255 417	184 256	156 423	6 424	15 995	94 221	995 691	44 344
Transkei	1 214 078	2 238 942	—	1 218 596	98 442	16 967	326 336	1 094 927	368 748
Ciskei	217 002	428 149	—	291 557	8 444	2 624	26 980	176 217	26 855
Bophuthatswana	384 384	44 780	210 372	499 991	17 739	49 960	22 335	426 616	29 170
Qwaqwa	6 315	4 022	—	9 605	989	34	253	9 508	480
kwaZulu	1 273 614	82 758	135 987	678 748	17 170**	39 342	36 294	848 662	79 026
Venda	111 969	—	3 400	51 598	4	4 100	6 500	20 000	1 700
Gazankulu	130 785	—	3 535	66 127	2	5 260	4 500	41 800	17 800
Lebowa	446 407	—	113 659	453 176	121	27 551	29 366	251 428	28 454
Total	13 216 287	22 062 092	7 523 158	5 767 671	370 157	220 766	1 528 954	44 828 560	1 317 261

* Please refer to next table for analysis of cattle figures

** The figures opposite "kwaZulu" refer to horses and mules. Donkeys are shown separately

DISTRIBUTION OF CATTLE

Region or Homeland	White owners		Non-White owners	
	White areas	Non-White areas	White areas	Non-White areas
Winter Rainfall	331 308	-	4 673	-
Eastern Cape and Karoo	848 970	-	31 882	-
Transvaal	1 951 022	-	184 636	-
Natal	1 255 743	-	251 819	24 204
OFS	1 225 787	-	14 148	-
Highveld	1 991 588	-	82 281	3 887
Eastern Transvaal	1 133 092	-	3 589	60 802
Transkei	1 241	-	-	1 212 837
Ciskei	-	-	-	217 002
Bophuthatswana	-	-	-	384 384
Qwaqwa	-	73	-	6 242
kwaZulu	-	660	-	1 272 954
Venda	-	-	-	111 969
Gazankulu	-	593	-	445 814
Lebowa	-	12	-	130 773
Totaal	8 738 751	1 338	605 330	3 870 868

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

Eleven scientists from African countries or neighbouring islands visited the Veterinary Research Institute during the past year. The following countries were represented: Botswana, Kenya, Malawi, Lesotho, Rhodesia, Reunion, Senegal and Swaziland.

Vaccine manufactured by the Institute was bought by the following countries:

Angola	1 000 000
Botswana	1 657 840
Lesotho	162 680
Malawi	1 244 565
Mozambique	370
Rhodesia	2 240 817
Swaziland	162 986
Zambia	7 961 500
Total	14 430 758

The Institute also received 826 specimens for diagnostic purposes from African countries.

Liaison with overseas countries

Forty-four scientists from 13 overseas countries visited the Institute during the past year. Of these, 31 were from Western Europe, 5 from North and South America and 8 from Australasia.

In addition 804 tourists from overseas visited the Institute in organised groups.

Technical assistance and advice

World Reference Centre for Bluetongue (OIE)

During the past year it was necessary to pre-

pare some of the type-specific antisera again and re-evaluate them.

Ten virus strains were received from the USA for typing. Three types were positively identified from these, viz Types 10, 11 and 13; a fourth type, which is apparently a new one, is still being processed.

World Reference Centre for Horseshickness (OIE)

No antibodies against horseshickness could be detected in serum specimens received from West Germany and Italy.

A specimen submitted from Botswana contained the horseshickness virus, but typing has not yet been completed.

Vaccines

The following vaccines were supplied to overseas countries:

Hong Kong	100
Israel	33 000
	33 100

Approximately 8,5 per cent of the total quantity of vaccine prepared by Onderstepoort was sold to foreign countries, mainly to African countries.

Study tours and official visits

During the year, 10 officers of the Veterinary Research Institute paid short visits overseas, which were financed either in part or completely by the Department. A further 3 persons spent longer periods overseas for study purposes.

The Director of the Division of Veterinary Services, Dr P.R. Mansvelt, and Dr J.P. van der Merwe, Deputy Director, visited Lesotho on 25 July 1974, Swaziland on 4 September 1974, Botswana from 13 to 15 January 1975 and Rhodesia from 30 April to 8 May 1975. These visits were in connection with an agreement between the Republic and these countries on the importing and ex-

porting of animals and animal products. Abattoirs, from which meat is exported to the Republic, were inspected in Botswana and Rhodesia. The Director and Deputy Director were accompanied to Lesotho by Drs J.M. Erasmus and T.A.T. Louw, Assistant Directors. They were accompanied on the Swaziland visit by Dr J.M. Erasmus only, but Dr Erasmus and Dr A.E. Gillespie, State Veterinarian, joined them on the visit to Botswana. Dr J.H.B. Viljoen, Deputy Director, was present on the visit to Rhodesia.

Drs P.R. Mansvelt, J.P. van der Merwe and G.P. Retief, State Veterinarian, attended the annual meeting of the SARCCUS Committee on Animal Health from 16 to 18 July 1974 in Lourenco Marques.

Dr J.M. Erasmus visited Réunion from 22 September to 1 October 1974 to give advice on a cattle farming project and investigate the veterinary

position there. He also visited Mauritius from 1 October to 3 October 1974 for consultations with the veterinary authorities there on matters of common interest such as the importing and exporting of animals and animal products to and from the Republic.

Dr G.C. Dent, Assistant Director of the Division, visited Mozambique from 29 July to 3 August 1974, and Rhodesia and Mozambique from 23 September to 26 September 1974, in order to determine the progress made by the joint tsetse fly spraying operations. He also attended the annual conference of the Office International des Epizooties in Paris, France, from 23 May to 3 June 1975.

On 13 December 1974 Dr P.P. Bosman, State Veterinarian, addressed the annual general meeting of the Rhodesian Veterinary Association in Salisbury on cattle diseases that affect reproduction.

8. Agricultural Engineering

Agricultural engineering embraces all branches of engineering that relate to agriculture; these may be divided into four main fields, viz:

- Agricultural mechanisation
- Farm buildings and structures, with the emphasis on livestock housing
- Water utilisation in agriculture, with the emphasis on irrigation engineering
- Engineering in relation to the conservation of natural resources

The Division of Agricultural Engineering was established in 1961 and plays a leading part in supplying engineering services in all the areas of the agricultural industry mentioned above.

These services to the farming community, the agricultural dealers concerned and Government bodies are directed at the pressing problems characteristic of the rapid technological development in all fields. Researchers attempt to find the answers to numerous problems through research, testing and development; their findings have to be conveyed to farmers, dealers and other persons interested in the agricultural industry without undue delay.

TESTING OF AGRICULTURAL IMPLEMENTS AND EQUIPMENT

The testing of agricultural engineering equipment remained one of the main activities during the year under review. Commercially available products are tested and reports are issued under the trade names of the products, enabling farmers to select equipment far more wisely than would otherwise be possible.

An additional advantage of the programme is that manufacturers are given considerable assistance with the development of new products in South Africa or with the assessment of imported products.

During the year under review four series of reports were issued. These reports covered maize planters (four units), pick-up balers (6 units), mounted disc harrows (10 units) and vineyard spraying machines (5 units). Altogether twelve series of reports have now been issued. In addition to those mentioned above, reports were issued on disc ploughs, mouldboard ploughs, single tine subsoilers, cattle scales, hammer mills, fertiliser distributors, milking machines, as well as a first series of reports on maize planters.

The testing of the following series of products is continuing: tine implements, agricultural fans, feed mixers, granular weedicide applicators, forage harvesters, mowers (cutter bar), semi-mounted mouldboard ploughs, a number of new vineyard sprayers, irrigation sprinklers, microtube drip systems and other equipment for drip irrigation.

There is an increasing demand for test reports. Despite the fact that the original printing of each series comprised over 15 000 Afrikaans and 8 000 English copies, it has been necessary to reprint several of the series of reports.

When a series of implements has to go through all the phases of a testing programme, which normally include the development of suitable testing techniques, laboratory tests, field trials, a consumer survey and the accurate preparation of the publication on the implements, it generally takes 12 to 24 months or even longer before the test reports are ready for publication.

All manufacturers and distributors again co-operated whole-heartedly an indispensable factor in the success of the undertaking.

AGRICULTURAL MECHANISATION RESEARCH AND DEVELOPMENT

Apart from the official testing of agricultural implements and equipment with the view of publishing test reports, a great deal of other research and development was undertaken with regard to agricultural mechanisation problems.

Mechanisation Planning

Mechanisation and labour represent a very large part of total costs in arable farming and the Division devoted considerable attention to assessing present mechanisation systems and labour utilisation on farms, principally in the Highveld Region. Current practices were analysed and a simple technique for developing a co-ordinated mechanisation plan for the farm was developed.

This technique was presented in the form of one-day and two-day courses or seminars, attended by farmers, dealers in machinery and co-operative society officials. The participants were divided into discussion groups, in which actual mechanisation plans were developed.



This roto-seeder developed at Cedara is used for radical veld improvement in pasture trials. The establishment of improved pasture crops in rows in the veld is done in a single operation, which includes soil preparation, fertilising, planting, application of weedkiller and pressing the seeds down. The machine is constructed mainly of standard parts

Tractor Liaison Committee

A Tractor Liaison Committee was established under the chairmanship of the Director of the Division. Importers and distributors of all 15 makes of tractors currently available in South Africa are represented on this committee. The committee meets quarterly and matters of common interest are discussed. This liaison committee has proved invaluable in ensuring that there is adequate contact between the various commercial concerns and the Division and has made consultation and action possible on a number of important common issues.

One consequence of the committee's deliberations was the establishment of a regular tractor sales information service, which is supplying a long-felt need of both the trade and interested Government bodies. The information is valuable to dealers from the point of view of advance planning.

Tractor power and traction studies

The factors which influence the traction that can be exerted by tractors under various conditions using normal single-drive wheels, dual wheels and four-wheel drive transmission were investigated in detail. An active extension programme was launched to guide farmers as to the best practical approach to getting the best out of their tractors.

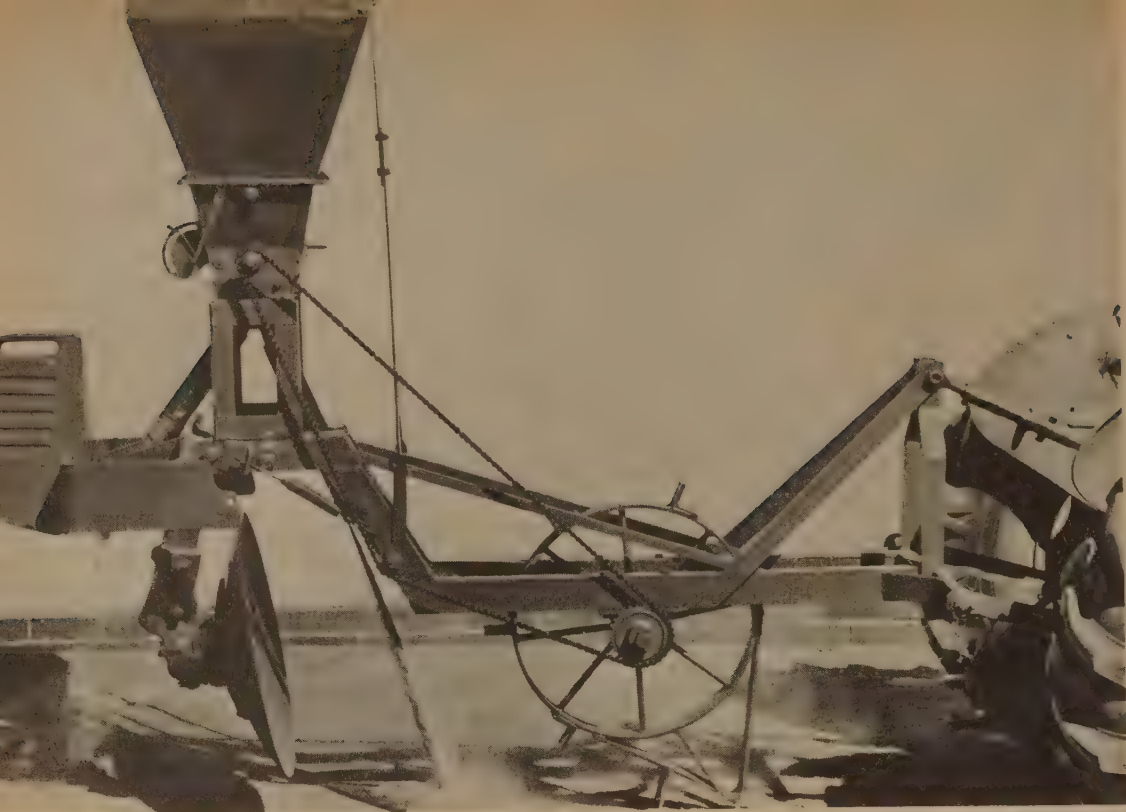
Modern tractors are designed to be operated

at relatively high speeds, but conditions in South Africa, as well as traditional practice, have lead to tractors being used at relatively slow speeds, which is scarcely to the farmer's advantage. The growing demand for short courses and demonstrations in this regard indicates that farmers are starting to realise the importance of knowing more about the capabilities of their tractors.

Combine harvesters

The investigation of the practical operation of combine harvesters in the field was continued and a report prepared on the performance of self-propelled combines for maize, wheat, sorghum and sunflowers. This report was discussed in detail by representatives of the farm machinery industry. Areas for possible further research were identified and the findings of the investigation confirmed.

The whole question of poisonous weed seeds and small stones in grain was investigated in co-operation with the Maize Control Board. In addition to farm surveys the efficiency of the rotary-type cleaning screen was investigated in the laboratory. It is evident that the ability of the combine harvester to separate poisonous weed seeds and small stones is limited. The way in which stones find their way into the machine was investigated and recommendations prepared.



The basin plough and fertiliser spreader developed by the Engineering Section of the Grootfontein Agricultural College. The plough is used for reclaiming bare patches of veld

Mechanical cotton picking

The efficiency of mechanical cotton pickers was investigated in collaboration with a team from the Transvaal Region. The loss levels and the methods that can be adopted to minimise losses, as well as the practical working rates and the factors that influence them, were investigated and put across to farmers at well-attended farmers' days.

Grain drying

Experiments on the low-temperature drying of maize in large silos were conducted in collaboration with the Maize Control Board and certain co-operatives. This work was followed up when the Maize Control Board sent a mission to the USA and Argentina to investigate the situation there. Two engineers of the Division accompanied this mission.

A comprehensive report containing recommendations was prepared and submitted to the Maize Control Board. In addition to work on maize drying, farm installations for the drying of wheat were investigated to see whether they damage the grain. Standard designs for farm grain driers are now being prepared.

Hay and forage production

Analyses were made of haymaking methods on the Highveld and in the Eastern Cape, with special reference to the possibility of utilising the

new stack wagons and large bales as a means of reducing labour and increasing efficiency where haymaking is affected by adverse weather conditions.

The equipment required for silage-making and the dehydration of lucerne was also investigated and reports that will serve as a basis for the planning of further research were prepared.

Conservation tillage practices

A number of farming methods utilising shallow tillage with a view to stubble mulching and similar practices are being introduced by various organisations and farmers in the Transvaal and Free State. These activities are closely followed by engineers of the Division and active extension is given to groups of farmers on where to incorporate these new implements in modern tillage systems and what problems are associated with their use.

Potato harvesting

The degree of damage to potatoes as a result of mechanical harvesting and subsequent mechanical sorting and handling was investigated in co-operation with agronomists from the Transvaal Region and officials of the Potato Control Board. It is evident that some degree of mechanical damage is inevitable with increasing mechanisation of potato production, although the degree of damage can be reduced by the correct management of the equipment. This investigation is continuing.

Bulk transportation of milk

The possibility of utilising aluminium milk tankers for the bulk transportation of milk was investigated as were the methods used for cleaning these tankers. A report on this work was submitted to the Transvaal provincial authorities.

Milking machine systems

Active research into milking machine components continued and was related to the official programme for the testing of agricultural engineering equipment. Extension work continued throughout this year at a high level and groups of farmers and trade groups attended special courses on mechanical milking.

Ultra-low volume spraying equipment for locust control

The feasibility of using ultra-low volume equipment for spraying locusts was investigated in collaboration with the Division of Plant Protection. As a consequence of the research undertaken by the latter Division and a brief investigation undertaken abroad by a combined team of engineers and entomologists, it was decided to go ahead with the development of equipment suitable for South African conditions and capable of being mounted on light delivery vehicles. The development of this equipment has proceeded satisfactorily and the testing of prototypes is continuing.

Mechanical harvesting of wine grapes

Three mechanical grape harvesters were imported into South Africa by various organisations during the year under review. The Division, in collaboration with the Oenological and Viticultural Research Institute, undertook an evaluation of these machines and of the quality of the wine made from mechanically harvested grapes. The work was undertaken in a number of different areas and a very realistic appraisal of the potential for mechanical harvesting was made.

This work was of special importance as it dealt with the efficiency of the machines as such and enabled the Institute to determine and assess accurately the quality of wine produced.

Winery equipment

The conventional method of using a thin layer of water for cooling purposes was compared with the various approaches to mechanical cooling. When the results have been evaluated the need for further research will be determined.

Fruit dehydration systems

The Californian type of drying tunnel was investigated for practical suitability as well as operational efficiency. This work, which was undertaken at Citrusdal, will be continued when the tunnels have been modified to eliminate some of the shortcomings that have been identified.

In the interim an experimental system has been installed in the laboratory and tests are being undertaken under controlled laboratory conditions. The objective is to simulate certain conditions in the larger tunnels and to establish design parameters. Investigations are also being undertaken to explore the possibility of replacing relatively expensive diesel fuel with coal for heating the dehydration unit tunnels.

Refrigeration and cold storage of fruit

Investigations were carried out, in co-operation with the Fruit and Fruit Technology Research Institute, with the object of comparing the refrigeration requirements of fruit in cartons with those of fruit in wooden boxes. The valuable information was used by the Deciduous Fruit Board for the design of suitable cardboard containers.

FARM BUILDINGS: RESEARCH AND DEVELOPMENT

The mechanisation of farming to save labour brings with it a growing need for the expert planning and design of farm buildings and related structures and equipment, especially in the case of intensive stock farming. During the past year the Division gave special attention to cattle fattening systems, dairy plants and pig housing, and to the pollution problems that go hand in hand with intensive housing.

Situation determinations on the housing of small stock and spray race installations for livestock were also started. Briefly, a few of the most important activities were:

Cattle fattening systems

The Division is actively engaged in the planning of the Drakensberg Co-operative Fattening Complex, which came into operation recently and is regarded as one of the best fattening complexes of its kind in the country. The planning of this system brought the Division into contact with the practical problems attached to this type of undertaking and several design standards were developed in the process. Valuable information was acquired on matters such as the choice of a suitable site, dealing with storm water run-off on the site, waste management, air pollution and the storage and provision of feed.

The Division is also closely concerned with drawing up legislation on pollution resulting from intensive livestock housing systems; this legislation



One of the three imported wine-grape harvesting machines is tested in a Western Province vineyard

is being drawn up under the jurisdiction of the Department of Health. Several guides on this matter will be ready for publication shortly.

Pig testing stations

The Division gave advice on the construction of three pig testing stations in the Republic and also supervised the actual construction work.

Farm buildings for agricultural high schools

The Division gave the Transvaal provincial architects a great deal of assistance with the design of simple but effective farm buildings for Transvaal agricultural high schools. The cost of these buildings is only about 40 per cent of that of the usual buildings for this type of school.

Spray race installations

Existing and available spray race installations are being investigated. A considerable amount of information has already been collected, and the guides that will be drawn up as a result of the investigation will be based on this information.

Calf housing

The information collected in the course of an investigation on this matter is being processed into practical plans and guides.

The staff of the Division in Natal gave active assistance with the establishment of an

experimental calf house at Cedara, where several low-cost crate constructions will be tested.

WATER UTILISATION: RESEARCH AND DEVELOPMENT

The activities of the Division with regard to water utilisation covered the following:

- Research and development, chiefly as regards irrigation equipment and techniques
- Testing of irrigation equipment
- Planning and design of irrigation systems
- Extension and training
- Professional auxiliary services

Testing, extension and professional services are dealt with under the appropriate headings. The following is a concise report on the remaining matters.

The object of research and development is to acquire specialist engineering knowledge of all needful aspects of irrigation, and other forms of water utilisation in agriculture, and apply this knowledge for the benefit of the agricultural industry. In addition to the testing of irrigation equipment, field surveys incorporating short-term trials, followed by studies of the available literature, were the general pattern of work adopted in order to identify problems fast and find practical solutions. The most important work undertaken in this connection is summarised below:

Flood irrigation of small grain on turf

A survey at the Brits irrigation scheme revealed that the characteristic cracking of this type of soil requires special attention to ensure satisfactory distribution efficiency with relatively small beds.

Flood irrigation at the Olifants River Scheme

A survey and a critical evaluation of the various systems were undertaken on the three soil types of this irrigation scheme. The depth and uniformity of irrigation applications were determined on 9 farms and recommendations were made with regard to bed dimensions and design, irrigation flow, and the use of infiltration meters, especially on sandy soils.

Drip irrigation

A far-reaching and intensive field investigation produced information that gave a new direction to research and led to laboratory tests on several parts of drip irrigation systems. Unless one is familiar with the possible snags and takes them into account they together with the interaction of design standards, and the properties and behaviour of the various parts, water distribution could become extremely uneven, which results in reductions in the yield. Expert design is therefore vital for success.

Evaluation of sprinkler irrigation

Surveys in the Stellenbosch and Komatipoort-Nelspruit areas showed the relative importance of the various design factors that help to determine evaporation losses, viz: sprinkler pressure, nozzle size, air temperatures, relative humidity and wind speed.

Mechanised sprinkler irrigation systems are rapidly gaining ground and are being studied at present.

Drop-size distribution and evaporation losses - Projects on the drop-size distribution of sprinklers and the evaporation losses that occur between the sprinkler and the soil were completed during the year.

Hydroelectric power generation - After an investigation a cheap method of generating power was developed; a centrifugal pump is coupled backwards and used as a turbine. This method has great potential for cutting costs.

Drainage practices and materials - An investigation in the Winter Rainfall Region yielded valuable information on construction methods, drainage machinery, drainage materials, the life of systems, etc.

Irrigation equipment

The following types of irrigation equipment were developed and/or improved:

An *electronic time switch* for automatic flood irrigation systems.

A *fibreglass venturi* to serve as part of a flow regulator for flood irrigation systems.

Considerable progress was made with the development of an *automatic irrigation system for trial plots*, where the readings on the thermometer are controlled by electronic sensors. This work is being undertaken in co-operation with the Fruit and Fruit Technology Research Institute and a 24-canal irrigation system is being used. The preliminary results are very encouraging.

The development of *evaporation pans that register electronically* was started in co-operation with the Fruit and Fruit Technology Research Institute. The test results are very promising, but the electronic parts appear to be sensitive to wind, which means that adjustments and/or refinements are required.

An implement that makes flood irrigation banks, at the same time eliminating the hollows on either side of the banks, has been designed and built.

A model of an automatic flood irrigation system, with an electronic time switch, was built for use as demonstration material during extension meetings.

THE PLANNING AND DESIGN OF IRRIGATION SYSTEMS

In the nature of things planning cannot be undertaken for individual farmers, but designs are evaluated and advice given to farmers. Several schemes were undertaken for the Government, however.

Government irrigation schemes

The following Government irrigation schemes received attention:

Vanderkloof Dam: The planning of the main canal area was completed; this included farm boundaries, road routes, water supply and drainage systems.

Ramah Canal: Assistance was given with the planning of the Rust and Bleskop areas.

Assistance to Government bodies

Department of Bantu Administration and Development: Several designs for irrigation systems were evaluated.

Kuschke Agricultural High School: An irrigation system was planned.

AGRICULTURAL RESOURCE PROTECTION

The main contribution of the Division of Agricultural Engineering to the Department's agricultural resource protection campaign was the following:

Run-off control planning in co-operation with the regional staff concerned; the construction of major soil conservation works in badly eroded and/or vulnerable areas; soil conservation research and development; and professional guidance on soil conservation engineering to the Division of Soil Protection and regional staff entrusted with the design of soil conservation works.

A few of the main activities of the past year are discussed in some detail below.

RUN-OFF CONTROL PLANNING

The results obtained with run-off control planning programmes, which are generally directed by regional engineers, have in many cases exceeded all expectations, especially in respect of the co-operation received from farmers. In many parts of the country farmers are past the stage where they require convincing. There are now long waiting lists of farmers requiring technical help and guidance on the surveying and design of planned works. The most important progress and findings are the following:

Highveld Region

In addition to the planning required in the preferential development areas of the region, large-scale planning has to be undertaken on individual farms at the insistence of the farmers, who have proved that they are prepared to follow the plans conscientiously. Consequently 600 farms were planned in addition to the planning undertaken in the preferential areas, where all the planning was completed during the year.

The area of the 7 preferential areas is 93 780 ha, 53 000 ha (57 per cent) of which consists of cultivated fields which have to be protected by means of contour ditches. It is estimated that 660 km of waterways with a total area of about 2 000 ha will need to be prepared and have a suitable vegetal cover established on them, and over 15 000 km of storm-water and contour ditches will have to be built.

Natal Region

The engineering section is actively engaged in the activities of the resource conservation team responsible for run-off control planning programmes. The team's work and a few of its findings are discussed below.

A programme on the protection of cultivated fields in Natal - Steady progress is being made as field technicians acquire more experience with the execution of the programme. As far as possible the planning is tackled on a catchment basis.

Veld reclamation programme - This programme has been started and 10 farms have been planned so far.

Tillage requirements of the steep slopes

in the Indian areas - It would appear that the only measure that provides adequate protection against soil erosion in these fields is the building of narrow bank terraces. This project is being tackled in co-operation with the Coastal Subregion and the Department of Indian Affairs.

Handling of crop residues in high-yielding maize fields - It has been found that with high plant populations and high yields, crop residues become a problem when fields have to be prepared for the next crop. Several possible solutions to this problem are being investigated.

Free State Region

Run-off control planning of the Korannaberg Catchment, which has a total area of 63 500 ha, has been completed. In all 25 major conservation works have to be constructed, 18 of which were classified as State works - i.e. works erected by the State and the owner of the land contribute a portion of the cost which corresponds to the direct benefit it derives from the work.

Karoo Region

The report on run-off control planning for the Brakspruit Catchment has been completed and the field surveys for the Grassridge Dam Catchment have also been completed.

SOIL CONSERVATION RESEARCH

Research and development on soil conservation is undertaken not only by the research team at Aliwal North but also by several members of the engineering staff in co-operation with members of the regional staff who are interested, depending on the need and the available facilities, and on individual interests. The following are a few of the most important achievements:

Soil conservation research team at Aliwal North

This team is working on a number of registered research projects and a few pilot trials. The chief aim is to develop simple and cheap but effective measures and structures for the reclamation and conservation of badly eroded and vulnerable soils.

Most of the trial sites are situated in the problem areas where reclamation and conservation are usually very difficult and expensive and are often uneconomic.

The year under review was characterised by an exceptionally high rainfall in the trial areas. On the one hand this had a very favourable effect on the plant establishment programmes in certain areas, but on the other hand the unusually severe floods that accompanied the high rainfall subjected some of the experimental work to exceptionally severe tests. The result was that valuable information was obtained.



Waterways that have been carefully planned, maintained and utilised are of fundamental importance to farmlands in many parts of the country. The effective waterway in this photograph is divided in two with an access road in the middle planted with *Eragrostis*. The grass is cut regularly for hay

The following are a few notable findings and recommendations on soil conservation works and measures that have emerged from the various projects:

Above State Works, systematic follow-up work on sediment deposits is of the utmost importance for optimum reclamation: maintenance should include tree removal, regular cutting of reeds and other cover, breaking up the sediment crust, flattening uneven sediment projections, erecting flow-retarding barriers in the sediment above the main structure and overseeding with suitable plant seed.

Treated-pole jacks in donga bends that are caving in, followed by the establishment of vegetation, are a very successful method of reclamation.

Closely spaced cheap, low barriers in dongas, systematically followed by the establishment of vegetation, have a wide application in the stabilisation of dongas.

Winter Rainfall Complex

The engineering section at Stellenbosch is engaged in processing data on the intensity and duration of rainfall in order to improve design standards for hydrological structures. Reports on this work are being prepared.

Surveys to determine the most desirable espacements for contour ditches in cultivated fields are also in progress.

A trial on the covering of watercourses with

polythene showed that the useful life of the material when used for this purpose is about 5 years.

Natal Region

Experimental run-off sites were laid out and equipped and work on a suitable rainfall simulator for use on these sites is in progress.

Existing contour systems in various parts of the region are being investigated in the course of a survey study, the object of which is to evaluate design standards and maintenance practices.

SOIL CONSERVATION WORKS

The design and construction of key soil conservation works in badly eroded or vulnerable soils are being undertaken by the Subdivision of Soil Conservation Works at Aliwal North. Key soil conservation works are major works considered necessary for the stabilisation of watercourse soils together with the surrounding areas. Special construction machinery, equipment and manpower, which farmers do not generally have, are required.

The following table reflects the progress made with this construction work.



The two photographs show the repair and stabilisation of dongas above protective structures, mainly by the planting of common reeds which are ideal for this purpose. The establishment of a dense plant cover in the sediment is of the greatest importance, not only for conserving the works but also for grazing

Year	New works completed	Value of works (R)	Number of works repaired	Value of repaired works
1974/75	17	463 137	25	217 830
1973/74	8	451 529	15	85 300
1972/73	3	765 759	17	149 317
1971/72	9	401 071	9	115 979

The progress made with survey investigations and designs can be summarised as follows:

The surveying of 5 catchments for the planning of State works was completed; these catchments were the Egmont Dam, the Montagu Dam, Slikspruit, Sandspruit and Palmietspruit.

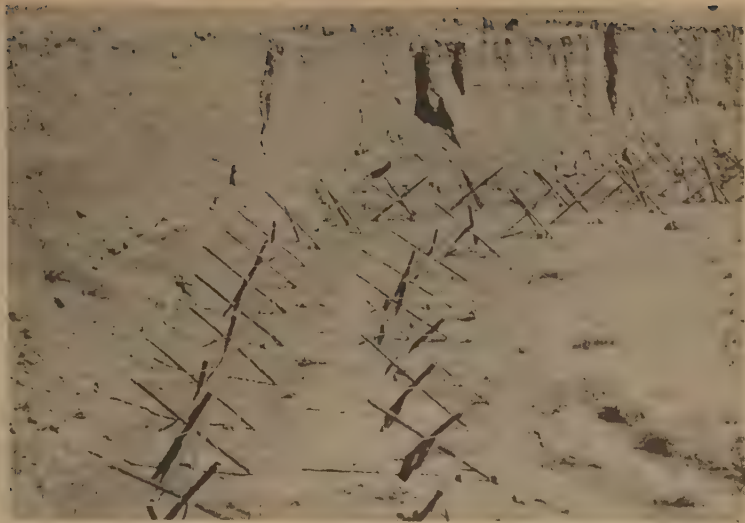
Twenty one designs of State and other major conservation works were completed, with the necessary plans and specifications. These include 17 new State works, 2 works that are supplementary to existing State works and 2 major farmers' works.

The diamond drilling unit completed two foundation investigations in the Egmont Dam and Montagu Dam catchments.

The building materials laboratory completed the following tasks:

Soil tests	55
Sand tests for concrete	12
Design of concrete mixtures	8
Compressive strength of concrete test blocks investigated	251

Jacks, a simple construction, together with common reeds, are particularly effective in protecting the banks of dongas on bends against erosion. In this donga the erosion was checked within a single season and the upright banks have started to flatten out and become reed-covered.



PROFESSIONAL AND TECHNICAL SERVICES

The professional and technical services the staff of the Division render to the various Departmental and other Government bodies, cover virtually all the engineering aspects of agricultural mechanisation, instrumentation, buildings and structures, soil and water utilisation and courses offered at agricultural colleges.

This is naturally the main function of the professional and technical services section, but it is also one of the most important functions of the engineering staff in the regions, and other sections also have to perform this type of duty, on account of their specialised knowledge.

A summary of a few of the most important tasks performed will give an indication of the nature and scope of this service:

Bulk storage of grain

The Division acts as technical adviser to the Grain Silo Committee and the Land Bank in terms of the loan scheme for the erection of bulk storage installations. Two engineers are working full time on this project. Their work entails the appraisal of new plans and submissions in respect of serviceability, cost and method of execution, and the certification of demands by contractors for loan funds.

In 1974 a total storage space of 776 600 m³ and total loan funds of R13 382 787 were allocated for 1975. These allocations include the three biggest plants ever planned in one stage, viz Meets (118 400 m³ i.e. 1 million imperial bags), Halfpad (118 400 m³) and Viljoenskroon (124 000 m³).

During the current financial year 812 400 m³ of storage space was approved and total loan funds of R16 863 000 granted for 1976.

Glasshouses and growth cabinets

The Division designs new glasshouses and alterations or extensions to glasshouses, as well as growth cabinets for the Department and other Government bodies and supervises the building of the structures.

During the year under review the following structures received attention:

Quarantine station at Stellenbosch: One 100 m² glasshouse was designed and completed for the Deciduous Fruit Board.

Horticultural Research Institute at Roodeplaat: Three small glasshouses were designed and completed. Seven out of ten projected growth cabinets were planned and erected in a recently completed growth cabinet building which is to serve as a phytotron complex, and a workshop complex was designed for the phytotron complex.

Cedara Agricultural Research Station: A R100 000 glasshouse was designed and 80 per cent of it has been completed.

Citrus and Subtropical Fruit Research Institute, Nelspruit: A 100 m² glasshouse was designed for the Citrus Exchange and is 80 per cent complete.

Potchefstroom Agricultural Research Station: Extensive improvements and alterations to 4 different structures have been designed and built.

Roodeplaat Research Station: A glasshouse was redesigned and rebuilt under the guidance and supervision of the Division.

Experimental farm development and agricultural research

Departmental research stations are calling on the Division to an increasing extent for professional and technical engineering services required for the execution of their research projects. The tasks performed cover a variety of aspects of agricultural mechanisation, farm buildings, and soil and water utilisation. Not only were plans and specifications drawn up, but the construction was often supervised as well.

The following are a few examples:

The purchase of agricultural implements: specifications were compiled and assistance given with the purchase of about 240 different items to a value of over R250 000.

An engineer of the Division is giving Onderstepoort and the Tobacco Research Institute full-time assistance with several research projects, which include research on meat drying units, refrigeration plants and the bulk curing of tobacco.

Farm buildings and structures for housing animals, implements etc. to the value of several hundred thousand rand were designed for Departmental bodies and assistance was given with the construction. These structures include workshops, several buildings for housing livestock (some of an experimental type), curing kilns, recreation complexes, stores and laboratories. The engineering section in the winter rainfall complex, where the biggest concentration of this type of building is found, assisted with buildings to the value of almost R150 000.

Water utilisation: Plans and specifications were drawn up for numerous irrigation schemes, stock watering schemes and drainage schemes relating to research projects.

Several special implements and types of apparatus required for research projects were developed and/or made on request. A few examples are: a new sod seeder for veld improvement at Cedara, a special spraying apparatus for the entomology section at Potchefstroom and a stainless steel steam generator for the soil science section at Glen.

The simple but effective electronic apparatus which was developed and/or built for the various research sections in the winter rainfall complex

deserves special mention. It varies from a simple water flow velocity meter to a sensitive thermometer for the regulation of oil bath temperatures, and a counter for counting a pre-determined number of stickers. A tooth harrow was equipped with adjustable coulters for working in maize stubble that had not been crushed fine. This enabled the plant disease section at Potchefstroom to carry out certain types of stubble cultivation that would not otherwise have been possible with the implement. These modifications and the successful results of the trial have suggested new possibilities for the development of stubble cultivation implements from conventional implements.

AGRICULTURAL ENGINEERING EXTENSION

Diploma students

The teaching of agricultural engineering subjects in agricultural colleges is becoming increasingly important as mechanisation gains ground in the agricultural industry. Last year's conference had a very healthy effect on the provision of uniform basic study material.

It is understandable that an increase in the demand for information should go hand in hand with progress in the testing of implements and equipment, and research into and the development of various aspects of agricultural engineering.

Interested persons are kept informed, by means of the radio and other news media, of the activities of the Division and the publications available. The result is visits and written enquiries to the Division and the regional engineering officers, and requests for short courses, lectures and demonstrations on subjects of immediate interest.

The increase has been such that several officers who originally did research only are now spending over 50 per cent of their time on extension work. As an indication of the nature and range of the Division's extension activities, a few matters are discussed briefly below.

Publications

The demand for publications has increased from an average of 750 a month in 1973 to about 5 000 a month.

In addition to announcements about

publications over "Calling All Farmers"; lists of available publications are distributed to interested persons on suitable occasions. Most enquiries about publications result from announcements over the agricultural programme.

Short courses, lectures and demonstrations

Numerous short courses, demonstrations and lectures were given not only to groups of farmers but also to agricultural extension officers or persons who, by the nature of their work, are engaged in extension. In the paragraphs that follow details are given of groups that were formed for training in some form or other.

In co-operation with the Department of Water Affairs and the Soil and Irrigation Research Institute, the training of sales representatives of the Sprinkler Irrigation Association of S.A. (which also does the designs) has been started by means of 4-week courses on irrigation. The aim is to train all the representatives (about 450) in time.

Several groups of sales representatives for agricultural implements attended short courses on mechanisation planning.

Groups of members of co-operatives entrusted with extension and/or design received training on the mechanical handling of groundnuts and grain, and drying plants for these products.

The senior diploma students of the Potchefstroom College of Agriculture paid a one-day visit to the Division.

About 20 of the learner technicians of the Department who are engaged in formal training attended 20 lectures/demonstrations on agricultural mechanisation at the Division. Transvaal municipal health inspectors, whose duties include the inspection of milk stalls, were instructed in the handling of milking machines and other aspects of dairy engineering.

Individual extension

Except where it is provided by members of staff who have been stationed in the regions, individual extension is confined to visitors to the offices of the Division. These visitors generally have pressing problems which they want to discuss with experts.

9. Additional Services

PLANT AND SEED CONTROL

Kind	Number of cultivars		
	Bred locally	Bred overseas	Total

VARIETY CONTROL

The Division exercises strict control over the identification of cultivars of varieties declared under the Seeds Act. Apart from physical purity, germination and the phytosanitary condition, the main criteria for determining the quality of seed are variety trueness and purity.

Before the introduction of seed into the trade is permitted, the name of the cultivar has to be included in the varietal list maintained in terms of the Seeds Act. Inclusion in the varietal list is subject to strict testing in the course of which it must be shown that the cultivar is distinguishable from other existing cultivars of the same kind, and is homogeneous and stable.

As soon as the seed of a new cultivar reaches the trade, further control is exercised in the form of sampling of the seed lots from time to time. The samples taken are compared with authentic samples and recognised descriptions of the cultivars in question, to determine whether they are variety-true and variety-pure.

Inclusion of new cultivars in the varietal list

The following table shows the kinds and the number of cultivars for which applications for inclusion in the varietal list were received:

Kind	Official		Private		Total
Maize	2	17	1		20
Grain sorghum	-	-	11		11
Cabbage	-	-	9		9
Lucerne	-	-	4		4
Soya-beans	-	2	1		3
Muskmelons	-	-	3		3
Onions	-	-	2		2
Cucumbers	-	-	2		2
Sweetcorn	-	-	2		2
Tomatoes	-	1	1		2
Silage maize	-	1	-		1
Rough cocksfoot	1	-	-		1
Weeping love-grass	-	-	1		1
Tall fescue	-	1	-		1
Peas	-	-	1		1
Beans	-	-	1		1
Carrots	-	-	1		1
Kale	-	-	1		1
Total 1974/75	3	22	41		66
Total 1973/74	3	42	51		96
Total 1972/73	8	44	21		73
Total 1971/72	1	37	46		84

The following table indicates the kinds and the number of cultivars of each kind included in the varietal list:

Kind	Number of cultivars included in the varietal list	
Maize	34	
Grain sorghum	26	
Tomatoes	8	
Gem squashes	6	
Carrots	5	
Muskmelons	4	
Castor oil	4	
Cabbage	2	
Cucumbers	1	
Cauliflower	1	
Dwarf beans	1	
Total	1974/75	92
	1973/74	81
	1972/73	60
	1971/72	38

Control tests for variety trueness and purity

- (a) 5 437 samples of 54 kinds of imported and certified seed lots and lots circulating in the trade were grown at the experimental plots of the Division in order to determine variety trueness and purity. This was almost the same number as last year.
- (b) A hundred or more samples of each of the following kinds were grown: maize, grain sorghum, sunflowers, forage sorghum, forage crops, beans, onions, tomatoes, cabbage, peas, muskmelons, lettuce, cucumbers and gem squashes.
- (c) Any samples that did not comply with the requirements were brought to the attention of the owners with a view to withdrawing the seed lots in question from the trade.

Service for testing variety trueness and purity

In order to assist importers of seed who do not have the necessary testing facilities, a service for testing variety trueness and purity was established in 1972.

Provisionally this service applies to only 3 crops, viz tomatoes, cabbage and cauliflower. An owner of a seed lot of these varieties can himself submit a representative sample to the Division of Plant and Seed Control for testing. The Division undertakes to plant the sample and produce a test report on the variety trueness and purity.

During the past year no samples were received for this service, probably because the field has been so thoroughly covered by the Division's post-control tests.

PLANT BREEDERS' RIGHTS

Under the Plant Breeders' Rights Act any person who has an interest in a new plant which originated in the Republic or in a country with which a reciprocal agreement has been entered into in terms of the Act can protect his rights with regard to such plant by having recourse to the Act. Applications for rights in respect of 6 new cultivars were received. This brings the total since the Act came into operation nine years ago to 70. Roses, wheat, tomatoes, maize, proteas and soya-beans are the varieties for which most applications for plant breeders' rights are received.

BREEDERS' PLANT MATERIAL

The purification and maintenance of cultivars in order to ensure propagation material of a high genetic quality, for use in the production of certified material, was continued.

Kinds propagated by seed

Maize

The purification of 24 of the inbred strains used for the production of public (SA) hybrid maize cultivars has virtually been completed and after satisfactory combination tests have been

carried out these strains will be made available to the industry.

Japanese radish

A new selection of the cultivar Nooitgedacht is being evaluated

Soya-beans

A purification programme with the cultivar Welkom was continued by the Highveld Region.

Dry beans

Eighty-four kg of breeders' seed of the cultivar B55/113 became available.

Cattle melons (Makataan)

Two promising strains have already been identified and are expected to be introduced into the industry in the prescribed manner shortly.

Lupins

1 350 kg of Breeders' Seed I and 25 608 kg of Breeders' Seed II of the cultivar Stevens were produced.

Rye grass

1 002 kg of breeders' seed of the cultivar Midmar, which was developed by the Natal Region, became available.

Vegetables

The Horticultural Research Institute made breeders' seed of the following kinds and cultivars available:

Beetroot - Crimson Globe

Cabbage - All Head

Onions - Alba, Atjar, Australian Brown, Bon Accord, De Wildt, Hojem, Pyramid, Sphinx and Texas Grano.

Gem Squashes - Rolet

The Division continued its purification programme with six *tomato* cultivars and about 80 kg of purified seed of the *runner bean* Witsa.

Production of disease-free bean seed

A scheme for the production of bacteria-free certified bean seed was started in co-operation with the Plant Protection Research Institute. The Institute will make a nucleus of disease-free seed available which will then be multiplied under the most suitable conditions for the prevention of re-infection.

Material propagated by vegetative means

Foundation seed potato production

There are two successive stages in the multiplication of virus-free foundation seed potatoes at Sabie, namely the entry phase and the production phase.

The entry phase is an additional measure to ensure that new material is really free from viruses before it is included in the production phase, from which foundation seed potatoes are supplied to the Potato Board for further multiplication. The following cultivars were in the entry phase: Sabie, Pentland Dell, 138/28 and 890/20.

Plantings for the production phase covered an area of 7,15 ha and the following quantities of foundation seed potatoes were obtained:

Cultivar	Mass (30 kg units)
Up-to-Date	3 899
BP 1	1 147
Van der Plank	392
King George	298
Cedara	148
Total	5 894

PLANT INTRODUCTION AND GERM PLASM

Plant introduction

It is the official policy that all imports and exports of samples of plant propagation material undertaken on behalf of Departmental bodies should be handled by the Division.

The Division has itself collected a large variety of indigenous material, largely at the request of the National Chemical Research Laboratory of the CSIR, and with a view to identifying kinds of seed that contain lectin. Four kinds of seed that tested strongly specifically positive for this character have already been found.

The following table shows the number of samples handled by the Plant Introduction Section:

Item	1974/75	1973/74	1972/73	1971/72
Number of samples exported	4 129	1 969	1 222	961
Number of samples imported for local researchers	3 205	2 105	1 143	833
Number of samples imported for rust nurseries	8 983	9 019	5 472	5 928
Total handled	16 317	13 093	7 837	7 722

The number of samples handled increased by over 3 000 since the previous year. The increase in the number of export samples handled was notably large.

Plant gene pool

The Division of Plant and Seed Control is responsible for preserving and maintaining genetically valuable plant material entrusted to it. This material is stored in the form of seed in cool, low-humidity rooms or propagated as vegetative material in nurseries.

A survey of the material that is available at

Departmental bodies and qualifies for preservation and maintenance was carried out. In all 233 samples were added to the plant gene pool.

DOMESTIC PLANT AND SEED SERVICES

Control over the seed trade

Registration of sellers and cleaners of seed

Registered sellers and cleansers of seed now number 347 and 67 respectively - a total of 414 against 425 the previous year.

The registered sellers and cleaners of seed are distributed as follows over the four provinces:

	Transvaal	Cape	Natal	Free State	Total
Cleaners	34	18	6	9	67
Sellers	144	118	53	32	347
Total	178	136	59	41	411

Control over the cleaning and sale of seed

There are 949 seed distribution points that have to be visited, and 2 298 inspections were carried out for the purposes of the Seeds Act. As a check on the quality of seed distributed in the trade, 2 034 seed samples (about 30 per cent more than the previous year) were taken in order to test germination, physical purity, weed seed content or variety trueness and purity. The biggest problem was found to be low germination and too high a weed seed content. Of the 1 187 samples examined for variety trueness, 6,6 per cent showed defects.

Advertisements in newspapers and magazines were checked and 30 persons who were selling seed without being registered as sellers were traced.

Offences, of which there are 14 different types, were committed chiefly by sellers of seed. Ninety per cent of the prosecutions were successful.

Sealing lucerne seed

The following quantities of lucerne seed were approved and sealed after being found to be dodder-free and to comply with the requirements for purity and germination:

Place where approved	Mass of seed approved and sealed	
	1974/75	1973/74
Oudtshoorn/Ladismith	495 600 kg	999 700 kg
Upington	35 425 kg	104 425 kg
Johannesburg	21 600 kg	50 434 kg
	552 625 kg	1 154 559 kg

Control over the quality of imported seed

A total of 1 906 samples of imported seed were taken and submitted for the determination of the physical purity, germination, weed seed content and variety trueness and purity.

The biggest increases in the inspection of imported seed took place at Durban and at the Jan

Smuts Airport. Rejections, for the reasons given below, occurred mainly in the case of the following kinds:

Germination too low: Soya-beans, spinach beet, gem squashes, pumpkins, kohlrabi

Physical purity too low: Eggplant, spinach beet, tomatoes

Weed seed content too high: Tall fescue, Italian ryegrass, bulb canary grass, Medics, clover, parsley, radishes.

Analysis, examination and testing of seed

The Division's Seed Testing Station tests, analyses and examines seed samples for purity, germination, moisture content, weed content and other properties related to seed quality.

The following table shows the total number of seed samples of field crop, horticultural and forest tree species received by the Division for various purposes:

Seed group	Certification scheme	Public	Purposes under the Seeds Act			Research	Total
			Trade checks	Export seed	Import seed		
Field crops	4 461s	2 809	1 328	522	405	132	9 657
Horticulture	905	2 969	907	4	1 188	138	6 111
Forestry	-	-	-	-	-	97	97
Total	5 366	5 778	2 235	526	1 593	367	15 865

The number of samples received was 1 642 higher than last year. Most of the samples received were of the following kinds: Maize, grain sorghum, forage sorghum, cotton, lupins, grasses, beans, peas, cole crops, pumpkins, gem squashes, radishes, tomatoes, onions and carrots.

Samples were tested for official purposes on behalf of a large number of bodies, including the Swaziland Cotton Board and the Gaberone Agricultural Research Station, in Botswana.

The number of tests of all types amounted to 38 594 (6 229 more than during the previous year).

Field inspection service

Seed certification

The following table shows the mass (kg) of seed certified under the various schemes:

Tabel A Crop group	Exp					Total
	Basic Seed Scheme	S.A. Seed Certification Scheme	Export Seed Scheme	OECD Certification Scheme for Forage Crop Seed And Oilseeds		
Vegetables	17 551	1 353 907	33 380	-		1 404 838
Field crops	581 984	35 898 262	-	492 125		36 972 371
Pasture crops	67	59 422	-	-		59 489
Total 1974/75	599 602	37 311 591	33 380	492 125		38 436 698
1973/74	260 070	23 229 677	85 846	63 207		23 638 800

The quantities of certified seed indicate a favourable production season. The increase in the quantity of seed (particularly lupin seed) grown under the OECD Certification Scheme for Forage Crop Seed and Oilseeds is especially striking.

The quantity of certified hybrid maize seed (35 834 229 kg) is indicative of a normal crop. An adequate supply ought to be available for commercial maize production for the next planting season.

It is clear that the quantity of certified public hybrid maize seed is still dropping and is being replaced by certified private hybrid maize seed. Seventy-nine per cent more yellow hybrid than white hybrid maize seed was certified.

PP X K64r remains the most important white hybrid in respect of seed production; its contribution was 25 per cent of the total white seed crop. However, this is a decrease of 13 per cent in comparison with last year's figure.

SA4 and SA4(MS) were the most important yellow hybrids and represented 29 per cent of the

yellow hybrid crop. Because of its unusual susceptibility to *Helminthosporium maydis*, SA4(MS) was withdrawn from further certification.

Dry bean seed production increased by 13 000 kg, to 87 450 kg.

The certification programme for lupin seed is starting to make progress. In all 590 330 kg of lupin seed, including all categories, was certified. Most of this seed was exported to an EEC member country. After 1 July 1977 the importation of lupin seed into EEC countries or the sale of it in EEC countries will no longer be permitted unless the seed is certified, and a large-scale expansion of certified lupin seed production in the Republic can therefore be expected.

Number of inspections carried out

The following table shows the number of

inspections carried out and the total area inspected per crop group:

Crop group	Number of inspections	Total area inspected and approved (ha)
Vegetables	1 609	4 611
Field crops (except maize)	284	3 262
Hybrid maize: white and yellow	4 011	18 711
Pasture crops	42	977
Total: 1974/75	5 946	27 561
1973/74	7 910	29 731

In all 40 dealers and co-operatives and 819 growers participated in these schemes. Seed of 20 kinds and 161 cultivars was certified.

Seed potato certification

Foundation seed potatoes (Potato Board's multiplication unit)

Field screening

The following areas (ha) of the various cultivars were inspected and approved:

Up-to-Date	37,65
King George	3,40
Cedara	0,60

No virus infection occurred and good yields are expected.

Tuber inspection

The following quantities (units of 30 kg) were offered and certified:

Up-to-Date	19 586 x 30 kg
King George	1 371 x 30 kg
Cedara	638 x 30 kg
Total	21 595 x 30 kg

AA certification regions

Field screening

the AA region, which is situated chiefly in the Northern Cape, the Western and Southern Free State and, to a lesser degree, in the Transvaal, the

Central and Eastern Free State, Natal and the Western Cape, 4 963 ha was submitted for inspection. This is 2 000 ha more than the previous year. 497 ha was rejected, chiefly on account of high virus infection.

Good yields are expected in general.

Tuber inspection

626 624 x 30 kg of tubers was certified, as against 518 866 x 30 kg the previous year - an increase of almost 100 000 x 30 kg. About 97 000 x 30 kg was rejected, chiefly for exceeding the nematode tolerances, potato tuber moth infestation, rotting of tubers or frost damage.

A certification region

Field screening

A grade potato tubers are grown chiefly in the Western Cape, the Transvaal, the Eastern and Central Free State and Natal. Of the 2 856 ha submitted for certification, 292 ha was rejected, chiefly for exceeding the virus tolerances, or on account of insufficient isolation from infected plantings and poor development of the plants.

Tuber inspection

509 865 x 30 kg of tubers was certified, as against 428 392 x 30 kg the previous year. This represents an increase of about 80 000 x 30 kg. About 41 500 x 30 kg was rejected for exceeding the nematode tolerance or for rot.

General

Cultivars

The following areas (all grades of certification included) of the chief cultivars were offered for certification:

Up-to-Date	3 266 ha
BP 1	2 903 ha
Van der Plank	1 283 ha
890/20	126 ha
King George	80 ha
Koos Smit	48 ha
Ilam Hardy	46 ha

Performance tests

In all, 1 337 samples were planted for purposes of performance testing. The tests give an indication of the efficiency of disease control by seed potato producers and their continued membership of the scheme depends on the outcome of these tests.

Plant improvement schemes

Grapes

A considerable amount of material was made available in terms of this scheme during the winter of 1975.

Parent blocks

Rootstocks

A total of 435 919 rootstocks, consisting chiefly of 101-14 and Richter 99, have already been established. It is estimated that about 5,4 million rootstocks will be obtained for certification from these nurseries.

Scions

Table grapes

Cultivars such as Waltham Cross, Barlinka, Queen of the Vineyard and Dan-ben-hannah have already been established. About 80 000 buds are expected to become available from these plantings, 75 000 being Waltham Cross.

Wine Grapes

93 269 grafted vines were established.

Drupe

Cherries - A total of 14 077 young trees were certified as visually approved material.

Peaches, apricots, plums - Scion and rootstock cultivars will be established as soon as possible on the farm of the SA Plant Improvement Organisation at Ceres. A total of 2 059 drupe trees are considered potential propagation material for this purpose.

Pomes

A total of 1 547 pome trees have been recognised as potential propagation material. The eyes already available amount to:

Apples	224 477
Pears	73 963

Strawberries

The scheme is progressing very successfully and making a considerable contribution to the improvement of the yield and quality.

Strawberries are produced in the Transvaal and the Western Cape and the following number of plants of the various cultivars were certified:

Parfaite	1 188 900
Torrey	321 600
Earlibelle	156 100
Selecta	122 700
Tioga	65 200

Roses

A scheme, which will initially be confined to the production of virus-free rootstocks, has been put into operation.

The production of flower bulbs for export

Winter bulbs - Sixteen bulb varieties, covering an area of 70 ha and producing 61,1 million bulbs, were submitted for inspection. An area of 0,75 ha, which produced a yield of 0,5 million bulbs, was rejected on account of virus infection.

Summer bulbs - A total area of 15 ha, on which 9 bulb varieties (yield 2,6 million bulbs) were grown, was submitted for inspection and approved.

Chrysanthemums - Two nurseries were inspected with a view to exporting cuttings. An area of about 6 ha, most of it under glasshouses, was involved. Chrysanthemum diseases such as *Erwinia chrysanthemii* and *Ascochyta chrysanthemii* caused problems.

NURSERIES

Registration

A total of 1 575 nurseries, 404 of which were vine nurseries, were registered with the Department. Most of the nurseries are situated in the Transvaal.

Diseases and pests

Forty-one nurseries were placed in quarantine, 29 of which were in the Transvaal and 12 in the Cape Province.

Quarantine was imposed chiefly on account of the following diseases and pests:

Nematodes, woolly apple aphid, red scale, Ross scale, pernicious scale, white peach scale, crown gall and *Phytophthora cinnamomi*.

Bacterial blight survey in vineyards

A total of 37 989 304 established vines were inspected for freedom from bacterial blight. This included reinspections of 12 properties where bacterial blight had occurred previously. No bacterial blight infection was found.

Inspection of fruit for scale

In all 1 293 018 units were inspected for the presence of scale; 4 785 were rejected. These inspections are carried out with a view to fruit exports.

Compulsory purification of orchards

With a view to the compulsory control of pernicious scale and grey scale, 960 spraying orders were issued in the 10 proclaimed districts in the Western and South-Western Cape.

A total of 462 samples were taken to determine whether scale was present and identify any scale found.

The average percentage control obtained was 84, as against 62 the previous year.

Control inspections in the declared areas for wart disease:

Two hundred and fifty-three plots were inspected to determine whether the provisions of the Act were being complied with. It was found that -

- (a) in seven cases the persons did not have the necessary permit for planting, and
- (b) in eleven cases susceptible cultivars had been planted.

No wart disease infection was found.

Embargo on the transportation of banana plants

In order to prevent the spread of burrowing nematode *Radopholus similis*, no person is permitted to transport or allow to be transported any banana propagation material in the Transvaal or Natal without a permit. Thirty-one permits were issued after 50 samples had been analysed and no infection had been found.

Imports and exports of plants, plant products, seed and bee products

Under the Seeds Act and the Agricultural Pests Act the Division can exercise control over the quality and/or phytosanitary condition of plants, plant products (including seed) bees and bee products that are imported and exported. Specific standards are laid down with regard to the quality of imported seed.

As a member of the International Plant Protection Convention, South Africa is involved in the world-wide campaign to control the movement over national boundaries of dangerous diseases and pests of plants and plant products.

The Agricultural Pests Act contains certain provisions relating to the phytosanitary condition of any such material imported into the Republic.

IMPORTS

Seed

The quantity of seed of declared kinds that was imported increased by 24 per cent - i.e. from 4 101 132 kg the previous year to 5 190 170 kg.

On the basis of the mass of seed imported, the various crop groups represented the following percentages in comparison with the previous year:

Crop group	1974/75	1973/74
Vegetable crops	47,80	42,99
Field crops	36,96	39,22
Forage legumes	3,13	1,43
Forage crops	12,11	16,36

The purposes for which seed was imported, and the quantities imported for each purpose, were as follows:

Seed imported for normal sales	5 050 861 kg
Seed imported for experimental purposes	12 281 kg
Seed imported for multiplication and re-exporting	5 502 kg
Seed imported for the production of processed or fresh products for export	63 776 kg
Seed imported because of a serious shortage of seed of listed varieties	57 750 kg
Total	5 190 170 kg

The seed imported for normal sales can be classified as follows:

Forage grasses	747 961 kg
Forage legumes	152 013 kg
Field crops	1 817 707 kg
Vegetable crops	2 333 130 kg

Plants, plant products and bee products

The table at the top of the following page shows the mass or quantity of the various kinds of imported material inspected for diseases and pests, together with the number of plant import permits relating to this mass or quantity of material.

A total of 11 918 import inspections were carried out on this material.

In cases where the requirements laid down were not complied with (704) the material was either destroyed (in serious cases) or the importer was permitted to return the material to the country of origin or to apply effective disinfection measures or to plant the material for observation under strict quarantine.

Imports of bulbs, tubers and rhizomes, seed potatoes and cotton dropped by 50 per cent, 80 per cent and 60 per cent respectively. The first containerised imports were received. Material infected with a *Toxix* species (an aphid as yet unknown in the Republic) and with very injurious nematodes, crown gall and mites was intercepted.

EXPORTS

Seed

Compulsory quality control is applied to export lupin seed only, chiefly in order to comply with the EEC requirements. International Seed Analysis Certificates are issued for seed on a voluntary basis. In all 306 certificates of this type, covering 4 165 480 kg of seed (chiefly lupins, serradella, maize, wheat and weeping love-grass) were issued.

Nature of imported material	Mass or quantity inspected	Number of plant import permits	Nature of imported material	Mass or quantity inspected	Number of plant import permits
Plants and cuttings	3 501 643 (units)	547	Broom-reeds	9 000 kg	4
			Beeswax	59 703 kg	19
			Nuts	635 173 kg	
Bulbs, tubers and rhizomes	28 896 236 (units)	159	Wood	317 572 m ³	
			Herbs, spices etc.	2 772 385 kg	14
Potatoes (seed potatoes)	475 794 kg	22	Cut flowers (fresh, dried)	25 239 kg	
Peat soil	67 040 kg	13	Fibre, cane, etc.	29 254 932 kg	
Seed (declared)	10 244 227 kg	762			
Tobacco	1 664 976 kg	14	Seed (undeclared)	6 867 124 kg	
Fruit	8 410 kg	11			
Cotton and samples	16 822 394 kg	191			

Plants and plant products

The table below shows the mass or quantity of the various types of export material inspected for diseases and pests, together with the number of phytosanitary certificates issued following such inspections:

There was a decrease in the quantity or mass of bulbs, tubers and rhizomes, wheat and vegetables exported. On the other hand, there was a marked increase in the quantity of seed, plants and cuttings, fruit, cut flowers and groundnuts exported.

The mass of maize exported was 26 times that of last year's exports.

Exports by air are still increasing, especially in the case of flowers, fruit and vegetables, and exports of fruit to new markets in the Middle East are also increasing.

The inspection of export material subject to phytosanitary control at the ports of export is carried out in co-operation with the Division of Inspection Services of the Department of Agricultural Economics and Marketing, which is responsible for quality control. In all 11 350 phytosanitary certificates were issued, as against 11 720 during the previous year.

Exported material	Mass or quantity inspected	Number of phytosanitary certificates issued	Exported material	Mass or quantity inspected	Number of phytosanitary certificates issued
Seed (general)	191 230 626 kg	1 209	Potatoes (seed)	3 512 802 kg	95
Plants and cuttings	27 850 252 kg	756	Potatoes (table)	9 278 136 kg	214
Bulbs, tubers and rhizomes	47 721 051 units	481	Maize	2 960 293 697 kg	764
			Vegetables, etc.	2 522 330 kg	295
Cut flowers	640 983 kg	2 428	Fruit	534 864 575 kg	3 949
Wheat	12 101 216 kg	15	Groundnuts	65 726 875 kg	908
Other	7 231 629 kg	214	Wood	1 480 m	22

NATIONAL COLLECTION OF INSECTS

GENERAL COLLECTION

Three field survey expeditions were undertaken to Natal (July 1974), South-West Africa and Namaqualand (September 1974) and the Northern Transvaal (March 1975), and several thousand specimens, including large series of Coleoptera, Heteroptera and Lepidoptera, were obtained.

Although the increment consists largely of known species, many of the taxa were either not previously represented in the National Collection of Insects (NCI) or were taken at new localities.

New collecting techniques were tested in the field, especially quick methods of killing locusts, beetles, emperor moths and other large insects. Injection with BHC emulsifiable concentrate or pyrethrum proved highly satisfactory.

A very severe outbreak of a Mexican sisal snoutbeetle *Scyphophorus interstitialis* Gylh. on *Agave sisalana* has been recorded at Wilsonsop near Komatipoort, with infestation levels of 60 per cent and higher. This is the first and only known record of this pest species in South Africa; production of a crop with so low a profit margin could seriously be affected unless this exotic pest is contained and eradicated.

NCI staff collected large series of the snout beetle at Wilsonsop and initiated studies of its life history.

Various new genera and species of Hymenoptera (Chalcididae and Pteromalidae) were described from Africa during 1974 by Dr Z. Boucek, Commonwealth Institute of Entomology, London: the author deposited in the NCI the holotype and paratype series of *Hybothorax palparisida*, and also paratypes of six more species in the genera *Colpixys*, *Hockeria*, *Watshamia* and *Leucospis*.

All Specidae and other large Hymenoptera in our collections were submitted recently for revision and determination to Mr H.N. Empey of Johannesburg.

The NCI collection of Coleoptera was augmented by types of numerous species of Buprestidae donated by Dr E. Holm in exchange for species not represented in the collection of the Entomology Department of the University of Pretoria. The types of two new species of Scolytidae from South Africa, recently described by Dr K.E. Schedl of Austria, *Liparthrum australis* and *Cryphalophilus devius*, were also deposited here.

During the year under review the General Collection processed 463 lots of insects submitted for naming. Of particular interest were two aphid species which occurred in pest proportions, neither of which had hitherto been recorded from South Africa: *Cinaria cronartii* on *Pinus patula* and other *Pinus* spp. and *Monellia nigropunctata* on pecan nut trees.

Much time was given to compiling programmes for the computerisation of data

concerning economically important South African insect species and types deposited in the NCI, routine curation of the General Collection and supervising the loan of NCI types of institutions at home and abroad.

Termites

Termite research staff dealt with 1803 routine determinations of Isoptera during the year under review: 1745 involved the classification of the termite increment to the National Collection of Insects (NCI) and 58 were of samples (not retained) which had been submitted for naming by persons and/or institutions at home or abroad.

The third scheduled National Survey of Isoptera (NSI) expedition to Rhodesia was undertaken during October/November 1974. The route followed traversed 24 magisterial districts between the Limpopo River and the Salisbury - Royal Inyanga National Park line. With 9 additional series from Southern Africa obtained through *ad hoc* collecting, and 11 samples from Angola, Brazil, Zaïre and Zambia received as donations, the termite increment to the NCI totals 1756 series in 32 genera.

At 30 June 1975 the NCI contained 32073 series of Isoptera.

An annotated list of types of Isoptera deposited in the NCI, the MS of which was submitted for publication in 1973, was published in June 1975. At specific and subspecific levels 407 termite taxa are represented in the NCI by type material.

Work on a series of papers (intended for publication) on the biology, ecology and geographical distribution of Isoptera recorded from Southern Africa was continued.

Studies on which a taxonomic revision of the African genus *Allodoterme* Silvestri will be based were continued: an additional 52 series collected in Rhodesia during 1974 were included and are expected to yield further useful data on speciation.

Subsequent to the publication in 1971 of a paper on the African genus *Protermes* Holmgren the NCI received seven more colony samples for naming from Angola, Zaïre and Zambia. The morphotype alate of *P. minimus* Ruelle was described in a follow-up paper which was sent to press early in 1975.

No deliberate surveys of termitophiles were undertaken during 1974-75, but 16 series (46 specimens) were collected in Rhodesia as a side issue to the third termite survey expedition. Host Isoptera included *Anoplotermes* (1), *Cubitermes* (5), *Macrotermes* (3), *Fulleritermes* (1) and *Trinervitermes* (6), spp. The termitophile increment comprises Diptera (3 Phoridae) and Coleoptera (32 Staphylinidae and 11 Carabidae).

Of particular interest is a unique staphylinid (probably a new species of *Physoperinthus* Kistner) taken from the nest of *Fulleritermes coatonii* Sands, the first termitophile ever to be taken in association with this host species.

During 1974-75 four papers on termitophilous

Coleoptera collected in Southern Africa through the NSI were published by taxonomists abroad.

Scale insects

Armoured scales

Routine identifications of armoured scale insects submitted for naming were supplied to persons and institutions in Angola, Israel, the Republic of South Africa and Rhodesia.

Two field survey trips were undertaken to the southern sector of South-West Africa (September 1974) and to the Clanwilliam district (October 1974). Approximately 50 new accessions were made, some of which consisted of undescribed species which are under study.

A study of the hitherto little-known South African species that are referred to the tribe Odonaspidini has been started. These are exclusively grass-infesting armoured scales; some of them being potential pests of sugar cane. This study has already contributed to a better knowledge of the number of species occurring in South Africa, their geographical distribution and the range of their host plants. It constitutes the first part of a world-wide revision of the Odonaspidini.

Six papers, five of them on armoured scales, were published during the year under review.

Mealybugs and soft scales

Routine identifications were made for, and advice given to researchers and institutions in South Africa as well as in Angola, Australia, Canada, Cuba, East Germany, Greece, Holland, Israel, Italy, Japan, Kenya, Réunion, Russia, Sicily and Uganda.

No field work was undertaken, undivided attention being given to laboratory studies and the compilation of data for publication.

Research on mealybugs centred on sorting out the status and identity of the vine mealybug *Planococcus ficus* Signoret and distinguishing it from the citrus mealybug *Planococcus citri* Risso with which it has often been confused during the past 60 to 70 years in South Africa and elsewhere. In addition to a large number of specimens from the southern districts of the Cape Province, specimens (old and new) from Algeria, Argentina, Chile, France, Israel, Italy, Lybia, Lebanon, Morocco, Portugal, Russia, Sicily, Syria, Tunisia and the USA were studied. The results are embodied in a paper which is now in the press.

A new set of observations concerning a small group of mealybug genera has been initiated: drawings and descriptions of new species are near completion. The genera to be treated are: *Allococcus* Ezzat and McConnell, 1956; *Cyberia* De Lotto, 1964; *Trionymus* Berg, 1899; and *Xenococcus* Silvestri, 1924.

In the field of soft scale research the following aspects have received attention: a study of a small group of soft scales attacking citrus in several countries is almost complete and the paper will be sent to press shortly; observations have been initiated on the probable taxonomic value of a

body structure for the recognition of a few species of wax scales common on citrus and other plants in Southern Africa.

Three papers on mealybugs and three on soft scales were published during the year under review.

Red locusts

The red locust *Nomadacris septemfasciata* (Serv.) continued to prove troublesome and the National Collection was again increasingly responsible for monitoring this locust species throughout Southern Africa and for co-ordinating all information, so as to keep neighbouring SARCCUS countries informed of developments in the south. National Collection staff actively participated in control operations against migrating swarms in Rhodesia in August 1974 and against incipient swarm formations in Mozambique in March 1975.

Following warnings of outbreaks from Mozambique in March 1974 and the placing of stocks of insecticide at strategic points in the probable invasion area of these swarms, two fast-flying swarms entered North-East Rhodesia in August 1974. Despite these preparations, the swarms penetrated some 200 km across Tribal Trust Territory before they could be destroyed. They were stopped just short of the main farming areas and were immediately followed by a third swarm which, however, flew back over the Mozambique border near Inyanga before it could be sprayed. Much further south a fourth, smaller swarm flew into the Melsetter district, but broke up of its own accord in the mountains.

These swarms, the largest of which was 2 to 3 km long in flight, undoubtedly originated in the floodplains of the Buzi near Beira. That no damage to crops was recorded was attributed mainly to the fact that the Tribal Areas these swarms traversed had in fact practically no crops growing at the time.

Report of a renewed locust upsurge from the Buzi outbreak area were received from local sources in November 1974, when heavy breeding took place in cane fields adjacent to the floodplains. Damage to maize and cane were reported. There was clearly a need for an early assessment of the locust position and low-level helicopter surveys of the Buzi and neighbouring areas as far north as Malawi that were also thought to have become infested were initiated in February 1975 with the help of the local agricultural authorities.

Six practically inaccessible and flooded swampland areas were thoroughly searched for locusts. Only in the Buzi area was the situation found to be sufficiently serious to warrant control. Elsewhere locust populations were low, but not without interest.

A spray unit, which drew its men and materials from Mozambique, Rhodesia and South Africa jointly, was rapidly mobilised and in the ensuing operations approximately 900 ha of infested plain, including one swarm on the point of departure, were sprayed from the air.

Control was satisfactory and the threat of outbreaks from the Buzi has been averted for the time being. However, substantial scattered locust populations remain on the plain and when the grass is burnt in the middle of the dry season more swarms could form. Surveillance of this dangerous area is proceeding.

Reports summarising the locust position and giving details of survey and control operations were circulated throughout the year to seven neighbouring SARCCUS countries liable to infestation by red locust. Technical talks on matters of mutual interest were held with Malawi and Botswana and lectures were delivered to selected agricultural officials.

A total of 515 red locust specimens, principally sampled from swarm formations in Rhodesia and Mozambique, were analysed morphometrically and incorporated in the grasshopper collection. This brings the total locust holdings since this work began to nearly 1000 specimens in the Cyrtacanthacridinae section of the collection. A small population of solitary red locusts discovered near Muldersdrift is being kept under observation.

Grasshoppers

Four field survey expeditions covering selected areas in the Northern and Central Transvaal, Namaqualand and Southern South-West Africa, together with *ad hoc* collecting in Malawi and Mozambique, yielded an aggregate of 1200 specimens of grasshoppers and numerous miscellaneous insects. These are currently being processed prior to incorporation in the NCI.

Notable among these long-range expeditions was the one to the remote Klinghardsberg range of the Southern Namib. The highlight of this expedition was the securing of a good series of the rare grasshopper *Micromethis kuthyi* from the coastal desert. It was formerly only poorly represented in the NCI.

In addition to dealing with routine enquiries from farmers and members of the public, the grasshopper staff undertook determinations for several universities and provincial departments.

Carpenter bees

Collections of solitary bees were made in Namaqualand, Southern South-West Africa and the Eastern Transvaal during 1974-75.

Data on fecundity, sex ration and mortality caused by parasites, predators and indeterminate factors in natural populations of 14 species of *Xylocopa* were analysed. The data consists of 27 samples from 19 sites covered by an extensive sampling method. Three out of six factors thought to be of importance in regulating natural populations of *Xylocopa* were dealt with. These factors are predation, parasitism and the availability of nesting substrates. The other three factors not measured are the availability of food, climate and fire.

Fecundity (on the average 6000 eggs are laid

per female) is similar for univoltine and multivoltine species. The sex ration is unequal with an average of 67 per cent females.

The biology and behaviour of carpenter bees in Southern African were treated in detail in a paper published during the year under review.

Parasitic Hymenoptera

Research continued on the taxonomy of this important group of beneficial insects with special emphasis on the two families Encyrtidae and Aphelinidae. A study of the species of *Microterys* that occur in sub-Saharan Africa was completed and some of the results published. On the basis of material received for identification, a similar study was undertaken on the Australian species of the same genus and was completed.

The species of *Microterys*, both in Africa and elsewhere, play an important part in the natural control of a number of soft scale insects.

Two other genera of the Encyrtidae were revised. Neither had hitherto been recorded from the Ethiopian region. The species of *Neococcidencyrtus* are parasitic in armoured scale insects. There are now known to be two species in South Africa, one indigenous and the other very likely introduced with its scale host. The genus *Metaphaenodiscus* is represented by three species in Southern Africa, all of which were described as new species. They are all probably parasitic in native South African species of mealybugs.

Fruit flies

A major project was proposed when Mr B.H. Cogan of the British Museum (Nat. Hist.) informed us that his institution was preparing a list of the Diptera of Africa and requested assistance in writing up the Tephritidae. This work would have demanded at least three months of undivided attention, time which could not be diverted at that stage from the *Davus* revision.

To render what assistance was possible, it was decided to lend the British Museum the card index of the Tephritidae that had been built up over the years by H.K. Munro. Owing to the work in progress on the Dacinae a separate, complete list of this subfamily could be supplied.

The main research project has remained the monographic revision of the African Dacinae and practically undivided attention has been given to completing descriptions of new species, redescription of old species where necessary and compiling a commentary. About 100 descriptions have now been completed.

Mites and spiders

Mite accessions during the year under review amounted to 468, with a total of 756 identifications, 120 of which were carried out for Turkey, 75 for Rhodesia and 47 for Israel. These identifications represent 85 species, which include 40 species of plant mites and other harmful species belonging to 6 families, 43 predatory species

belonging to 16 families and 2 species of soil mites representing 2 families.

During the year under review 135 specimens were collected from agricultural crops and wild plants.

Spider accessions amounted to 350. Identifications were carried out chiefly for researchers from this Institute and other agricultural institutes engaged in biological work. Requests for assistance with identifications were also received from museums.

Nematodes and earthworms

The national collection of nematodes was expanded and now comprises 10 830 slides, representing 51 300 specimens. A collection of South African earthworm species has been started.

Taxonomic studies of plant-parasitic nematode groups were continued. The study of the genus *Helicotylenchus* was completed. Two new species were described in the study and 16 known species were reported from South Africa. An identification key was also compiled. About 300 specimens of the genera *Rotylenchoides*, *Dolichodorus*, *Radopholus* and *Pratylenchus* were studied and named.

During the year under review about 500 routine specimens and other enquiries were dealt with. They were received from farmers and private Departmental bodies.

Red-billed finches

Last year, unlike the previous year, the Department waged a fairly intensive campaign against red-billed finches *Quercula qeba*, particularly in the Northern Transvaal, which includes the Springbok Flats, and in the North-Western Free State.

From November 1974 to April 1975, at the height of the finch plague, a total of 94 roosting and breeding swarms were sprayed in these areas; the spraying covered a total area of 1 303 ha.

The cost of the campaign to control the finches was R210 000,00. Aeroplane chartering and the purchase of sprays were the main items.

The Department created posts for finch control officers. The incumbents of these posts are stationed at Pietersburg, Nylstroom and Potchefstroom.

Rodents

Control measures against mice and rats during the year under review were based on the possible use of anticoagulants against field species. In the past acute poisons were mainly used. Laboratory tests with chlorophacinone against *Tatera brantsii* were continued during the year under review and high susceptibility to this preparation was found. In order to ascertain the lowest dose and the shortest application period that can ensure effective control, comparative trials with the various anticoagulants registered in South Africa were started.

Gerbilles caused problems in the Balmoral,

Witbank, Belfast, Koster, Tarlton and Delmas areas. Although there were indications of a build-up of the pest on the Highveld, the abundant rains during the year apparently kept mouse numbers fairly low.

INSECT CONTROL AND RESEARCH

Re-registration of insecticides and fungicides commenced on July 1974. Applications for the re-registration of some 800 pesticidal products have been reviewed.

A further 30 amendments to previous registrations and several new compounds have been recommended for registrations.

The annual departmental communication "n Handleiding vir die Gebruik van Plaagdoders en Swamdoders in Suid-Afrika" was updated and appeared in February 1975.

The Technical Adviser (Insecticides and Fungicides) to the registering officer (Act 36/1947) attended the 8th Session of the FAO/WHO Codes Alimentarius Committee on pesticide residues in The Hague. Active participation in the activities of this committee throughout the year has been maintained in view of the importance of the question of pesticide residues on our export edible commodities.

Brown locusts

The campaign during the year under review was necessitated chiefly by the large number of egg-nests formed during the previous season (1973/74). Incipient outbreaks made a minor contribution.

The campaign started on 20 September 1974, and 10 days later 31 magisterial districts were participating. Early in January 1975 the campaign was virtually over. Minor, isolated outbreaks occurred up to and during March 1975.

A total of 46 magisterial districts participated.

The campaign was waged chiefly against hopper swarms, and reached a peak in November 1974 when 394 control units and four aeroplanes were used.

In all 168 406 hopper swarms and 5 460 flyer swarms were destroyed. The total consumption of poison was 1 283 metric tons of BHC powder, 12 575 litres of emulsifiable concentrate and 2 000 litres of ultra-low volume formulation. The cost of poison, labour and transport amounted to R1 487 409,00.

There are no known egg-nests and it is only in a few districts that the locust populations are of such a nature that incipient outbreaks (and minor ones at that) can be expected during the 1975/76 season.

Because of the inherent dangers of the continuous large-scale use of BHC powder to control locusts, the Division of Agricultural Engineering is at present giving priority to the development of ground application equipment that will make it possible to use liquid on an ultra-low volume basis. The prototype of the equipment has

already been completed and is being tested under field conditions.

Karoo caterpillar

During the 1974/75 season the Karoo caterpillar *Loxostege frustalis* appeared only in the drier western parts of the Karoo in the autumn months. Severe outbreaks were not in evidence and only a single generation was recorded.

This westerly shift is conceivably a consequence of the good rains, which fell in the Eastern and Central Karoo during the preceding two seasons and probably created conditions unfavourable to the insect.

The long-term aims of the research programme remain to determine the pest's economic significance and to examine the possibilities of control. However, research into the biology and ecology of the insect has for many years been frustrated by the unavailability of regular supplies of live insects.

Consequently the interim research priority is to examine the feasibility of rearing the insect under artificial laboratory conditions. Promising results have been obtained with the use of synthetic media. If it should emerge that the insect's larval diapause can be controlled or manipulated a valuable culture is envisaged.

It has become increasingly clear that for the ultimate aims of the project to be realised, it is essential that the existing knowledge of the biology of *L. frustalis* be broadened. This is therefore a further short-term research priority.

Armyworm

The past year was characterised by an absence of outbreaks of armyworm *Spodoptera exempta*. Isolated outbreaks, none of which was serious, were reported in the Transvaal.

American bollworm

All work on *Heliothis armigera* was completed during the past year and the results were processed. This research is being written up at present. The study dealt with the incidence, distribution, proportion of the sexes in the light traps, migration and the effect of macroclimatic factors on the flying of the adults.

The number of light traps in operation was considerably reduced. Ten pest species of the family Noctuidae are counted regularly in light traps situated at Vaalharts, Citrusdal, Nelspruit, Messina, Zebediela, Rustenburg, Rust de Winter and Grootfontein (Middelburg).

Grain sorghum stalk borer (*Chilo partellus*)

Light trap catches and suction trap catches at the Towoomba Research Station again showed two peaks - during the first half of October and the first half of March. Trials showed that where sorghum plants were infested 35 days after planting the crop loss was 86 per cent, whereas stalk borer infestation after the piping stage had very little effect. In

practice only 20 per cent of the plants are infested before the piping stage.

Stalk borer infestations occur along the edges of fields at the start of the season, but by the end of the season they are found throughout the fields.

Of the 32 grain sorghum varieties tested, DC 109 showed the highest resistance to *C. partellus* infestation, and SSK 2 was the most susceptible. Monocrotophos provided good control, especially of the younger larvae. It took two weeks for the true effect of this preparation to become evident.

Sugar beet nematode

An investigation showed that tomatoes (Manapal) and cabbage (N.S. Cross) are hosts to the sugar beet nematode *Heterodera schachtii*. Tomatoes (Manapal) are a poor host, but cabbage (N.S. Cross) is a good host to the sugar beet nematode. The red beet varieties Detroit Dark Red and Egyptian Flat are very good hosts: a high population builds up after 90 days.

A biological investigation over a period of 11 weeks showed that tap water produced a relatively good hatch of sugar beet nematodes, whereas secretions from tomato roots produced a relatively poor hatch. The secretions from beetroot roots produced a good hatch (about 50 per cent) over the same period. However, it appears that only some of the larvae hatched in cysts during that period.

Earthworms

Biological studies of earthworms were started. The aims of these studies are to study the behaviour and ecology of the indigenous species of the Acanthodrilidae and compare them with the imported, non-indigenous species of the Lumbricidae.

A further project will involve the study of the excrement of earthworms and its effect on the germination and growth of plants. Preliminary studies on the subject are being carried out and aspects such as temperature, moisture and the organic content of soil are being investigated.

Forest and timber insects

Several outbreaks of *Euproctis terminalis* occurred in the Eastern Transvaal Highveld. An aerial spraying experiment was conducted at Jessievale in July 1975. No results are available yet.

Several outbreaks of the black pine aphid *Cinara cronartii* occurred in the Transvaal and Natal. A wide variety of pine species are attacked by this insect. No damage to the trees has been observed so far.

No outbreaks of *Pachypasa capensis*, *Nudaurelia cytherea* or *Cleora herbulotti* were reported.

Several queries chiefly from members of the public on wood borers in living trees were received, and dealt with. An outbreak of *Goniapterus scutellatus* was observed for the first time on *Eucalyptus macathuri* in the Lothair district.

A big outbreak of *Nudaurelia cytherea* occurred in the George-Knysna area.

About 2 000 ha was successfully treated with *Bacillus thuringiensis*. The Western Cape was fairly free from infestation by this pest this year.

The planning of a new research programme on timber insects was started. An experimental pressure cylinder was installed for this purpose at Rosebank. Colonies of lignivorous insects were established for purposes of experimental work. The establishment of colonies of *Cryptotermes brevis* was so successful that experimental work on the susceptibility of over 200 species of timber, indigenous as well as exotic, was started.

Discussions on the incidence and control of lignivorous insects in South Africa were held with the Department of Forestry with a view to introducing new legislation.

Insects in stored grain

During the year under review a new approach was followed in respect of research on the control of insects that attack stored grain. In terms of the new policy a nation-wide survey of resistance and cross-resistance to insecticides (something which is being encountered all over the world) is being carried out.

At the same time potential grain protectants are being tested in the same laboratory, using susceptible insects. The aim is to develop an efficient and economic insect control programme.

Pesticide residues

Several trials were undertaken to determine the residues of certain pesticides on agricultural crops stored grain and in agricultural soil and river water. Residues on certain agricultural crops were studied so that the use of pesticides and biological control methods could be combined effectively.

Where parathion was used to control aphids on grain sorghum it was found that the parathion residues broke down very rapidly, so that they were virtually absent three days after spraying.

The precipitation and residues of tetrachlorvinphos on cotton leaves are important in the control of the cotton bollworm. When this preparation was applied late in the season the precipitation was lower and the residues persisted for a shorter period than when it was applied to young plants. Climate plays an important part in determining how long residues will persist.

The use of phorate as a soil systemic preparation against cabbage aphid resulted in a metabolite of this preparation building up in cabbage; this could produce undesirable residues from the point of view of marketing.

Pirimiphos, a possibility for use on stored maize and wheat, breaks down so slowly that it can cause undesirable residues in the grain.

The use of endosulphan on cotton results in a considerable amount of this preparation landing in the soil, but it was found that the residue breaks down rapidly and so does not accumulate in the soil.

Studies to determine the effect of the pollution of rivers with insecticides showed that

endosulphan pollution occurs at very low concentrations, but that environmental factors such as current strength and temperature have a greater effect on the numerical strength of water insects and fish than the insecticides.

It is sometimes necessary to use fenthion against red-billed finches near the rivers, but the effect of this preparation on water fauna and the possible dangers for man as a result of residues in drinking water were hitherto unknown. It has now been established by means of a trial spraying along the Lower Orange River that water insects are wiped out by direct spraying or when the preparation is carried down by the river water. Fish are not affected at all, however. The highest concentration of fenthion that could be found in the water was still considerably lower than the acceptable minimum permissible intake for man. These results did not apply to slow-flowing rivers or dams. The water of rivers that flow into the Kruger National Park was monitored for pesticide residues. In a few cases residues, including residues of DDT and dieldrin, were found in the water at relatively low concentrations.

BENEFICIAL INSECTS

BIOLOGICAL CONTROL OF -

Jointed cactus

Work on quantitative population studies of jointed cactus *Opuntia aurantiaca* and studies on the interrelationship between this host plant and its natural enemy *Dactylopius austrinus* indicate the potential of this cochineal for controlling jointed cactus in certain ecological regions.

This information points to the possibility of suppressing jointed cactus infestations effectively by manipulating the cochineal populations.

The host specificity tests of the moth borer *Tucaminia tapiacola*, which was introduced from South America to control jointed cactus, have reached the final stage.

A new stem borer weevil *Cactophagus fahrei* was introduced from Mexico for the biological control of jointed cactus. The weevil originated from a related species, namely *O. pumila*, and is now being reared on jointed cactus plants.

Imbricate cactus

D. tomentosus which was released on infestations of imbricate cactus *Opuntia imbricata* in 1970 in the Free State Region gave excellent results. This cochineal is particularly effective on young plants. The old-established infestations have already largely disappeared and the remaining plants which are defoliated every year show clear signs of deterioration.

Hakea

Large-scale collections of the two insects cleared for release against *Hakea* spp., i.e. the beetle *Erytenna consputa* and the moth *Carposina*

autologa, were made in Australia. Attempts were made to establish stocks from the drier, inland areas of Australia, since these may have a better chance of surviving dry summer conditions.

Several thousands of each species were received in the Southern and South-Western Cape. Supplies of other promising insects were also collected and colonies are being established in quarantine for further tests.

These insects include two stem borers (*Aphanasium australe* and *Uracanthus triangularis*), the fruit borer *Aphanosperma occidentalis*, the seed sucking bug *Sangarius paradoxus* and a bud-attacking wasp *Xenostigmus mirostigmus*.

Small colonies of *E. consputa* and/or *C. autologa* at Stellenbosch, Franschhoek and Molenrivier survived, but significant increases in numbers have not yet occurred. Attempts at mass-rearing *C. autologa* on an artificial diet were continued.

Prickly pear

Cactophagus spinolae, the prickly pear stem weevil, is still abundant at all the release sites.

A brief larval survey at Springfield, Uitenhage, revealed a total of 1037 new infestations, as against 480 in May 1974. These figures were recorded over an extensive area. No beetles were released at Springfield.

At Springfontein, Uitenhage, 10 635 beetles were released between July 1948 and March 1952. A survey revealed 550 new infestations compared with 603 the previous year. After all these years this insect is still present where it was originally released, except that many of the weevils have crossed the Swartkops River to Springfield. This insect has done exceptionally well on this farm.

In November 1974 326 beetles and 255 cocoons were collected and taken to Douglas in the northern Cape where they were released on *O. imbricata*. At Hankey where 14 338 beetles were released from August 1969 to May 1971, 513 new infestations were recorded in May 1975, compared with 1 538 a year earlier. The decrease at this site during the past year cannot be explained.

Lantana camara

Twenty-five thousand specimens of the two Hispididae, *Octotoma scabripennis* and *Uroplata girardi*, were collected in Australia and released at Nelspruit and Margate. The initial establishment appears very promising at both sites. Four hundred larvae of *Plagiohammus spinipennis* were also received from Sydney. It is hoped to release the adults next summer. *Teleonemia scrupulosa* is now well established in and around Tzaneen, and *O. scabripennis* still has to be recovered in small numbers at Buffelspoort.

Silverleaf bitter apple

The leaf-feeding beetles *Gratiana lutescens* and *Gratiana pallidula* were imported from Argentina and Mexico and studied under

quarantine at Stellenbosch with a view to the control of *Silverleaf bitter apple* *Solanum elaeagnifolium*.

The two species were found to interbreed readily, which suggests that they are more likely subspecies. In host specificity tests both *G. lutescens* and *G. pallidula* were found to feed freely and develop on the egg plant, *Solanum melongena* consequently work on these insects has been discontinued.

Australian acacias

Research into the possibilities of biological control of Port Jackson *Acacia saligna* and golden willow *Acacia cyanophylla* was started in Western Australia during the year under review. In Australia a large percentage of the seeds produced by these two species are destroyed by insects.

Dubbeltjie

A survey of the insects associated with the dubbeltjie *Tribulus terrestris* confirmed earlier work done abroad which showed that there are a limited number of host-specific insects on the plant.

Of those found, the most important were the fruit-boring weevil *Microlarinus pilosus* and the stem-boring weevil *Microlarinus lypriformis*, whose northern counterparts have been used with some success in biological control projects in the United States.

Two foliage-feeding lepidopterans, *Prodotis stolidus* and *Tegostoma subditalis*, also emerged as possible candidates for use in biological control.

Apart from these insects on the plant, a complex of sucking bugs was found existing under the plant on the seeds within the dry *T. terrestris* burs. Some of these such as *Deroplax* sp. appeared to be rather restricted to *T. terrestris* as a host.

All these insects were, however, heavily attacked by parasites which confirms the generally held view that *T. terrestris* is indigenous in South Africa. Prospects for using insects in South Africa for the biological control of *Tribulus* are not good.

St. John's wort

All chemical control of St. John's wort *Hypericum perforatum* has now been discontinued after about two decades of attempting to confine the weed to the original infested areas the emphasis is now on biological control, which holds considerable promise.

Over 10 000 *Chrysolina gemellata* beetles were released at infestations near Grabouw and Tulbach. The midge *Zeuxidiplosis giardi* was released and later recovered from both these areas, and further new releases were made.

Around the original release site at Stellenbosch pressure is being exerted on the weed and galls were common on weakened, stunted seedlings. A supply of larvae of the root-borer *Agrilus hyperici* was obtained from Australia, and a batch from California was successfully manipulated to yield adult beetles at a time when the plants had stems suitable for egg-laying.

Pairs of beetles were confined on potted plants as well as at Ida's Valley (Stellenbosch) and despite very unfavourable conditions at the time of release, a colony may establish.

Grain sorghum aphid

Feeding trials with the two tortoise beetle predators of the grain sorghum aphid *Cheilomenes propinqua* and *Adonia variegata* were completed and behaviour studies of these two predators are being undertaken at present. Over 500 tortoise beetles were collected in the field in order to determine the effect of parasites on these beneficial insects. Parasitism of these predators was very low, however.

Trials to determine injury were carried out at the Roo-de-plaat Agricultural Research Station and revealed that crop losses caused by aphids take place right from the earliest growth stage of grain sorghum.

Two consignments of live *A. variegata* were sent to Dr E. Salinas at the Instituto de Investigaciones Agropecuarias, La Cruz, Chile, for release there.

Several spraying trials were carried out to determine the effect of various insecticides generally used against aphids on the natural enemies of the aphids. A new carbamate compound, pirimicarb, gave very promising results from the point of view of selective aphid control. Up to 80 per cent of the tortoise beetle population is able to survive a spraying with pirimicarb.

Trials with granular systemic insecticides were also undertaken. Disulfoton (5 per cent granules) again produced excellent aphid control, at an estimated cost of R14,50 per ha. The rapid rise in aerial spraying costs has brought this preparation within the economically acceptable price range for the higher yield areas.

Experiments with carbofuran have shown that this preparation produces very significant control of the sorghum stem maggot *Anatrichus erinaceus*.

Virus diseases of pest insects

Progress has recently been made with the isolation and identification of bacteria in viral suspensions, a necessary prerequisite for the marketing of a biological insecticide.

Bacterial extractions from 10 individual virus-killed larvae and two batches of 70 larvae have yielded repeated isolation of two bacteria on all occasions and of a third and fourth from the mass extractions.

The first and most frequently isolated has been identified as *Bacillus cereus*. This organism is known to be widely distributed in soil, dust and on plant surfaces and is not considered to be a pathogen of humans or animals. Its presence does not therefore constitute a hazard in the final viral product. The remaining three isolates have yet to be identified.

Another aspect of formulation is also being dealt with, namely protection of the virus from the ultra-violet rays of the sun. As a first step,

researchers are trying to determine the dosage of ultra-violet light that renders the virus inactive.

It has been determined so far that exposures of three, six and ten minutes do not harm the virus, since 100 per cent mortality due to the nuclear polyhedrosis virus has been obtained.

Interesting cases of parasitism of the bollworm by two different members of the order Diptera; *Phorocera blepharipa* and *Goma bimaculata*, were noted at Addo, the percentage parasitism having been calculated as 31,1 per cent. Large-scale field trials are being planned for the coming season.

Honey-bees

The beekeeping industry is not only expanding but also becoming more sophisticated. This is due in part to the general realisation that to grow satisfactorily a coherent organisation is needed. To this end a functioning advisory committee, consisting of members of the industry and of the department, has been formed. This body is collecting information for census purposes.

Progress in the industry is also due to the continued interest by overseas beekeepers and research biologists in the adansonii honey-bee *Apis mellifera adansonii* which was introduced into South America some 20 years ago. This has focussed the limelight on South Africa as the most advanced beekeeping country in Africa, where this subspecies of honey-bee is indigenous. The result has been tours to South Africa; our leading beekeepers have also recently toured countries that have very advanced beekeeping industries.

The latest such tour was to the United States, Mr M.F. Johannesmeier of the beekeeping section being a member of the party.

The honey processing project has shown that liquid honey absorbs heat much more easily than granulated honey. If these two components are not separated in processing, severe heat damage can be caused to the liquid phase while attempting to liquify the solid phase.

The microsporidian *Nosema* is usually a parasite of adult bees, however, a form which attacks the brood, especially the mature larvae, has been found. Cross-infection tests have been carried out to try to establish whether the same organism is in fact involved. The organisms appear to be selective in their ability to infect. The nesting sites of the three solitary bees involved in lucerne pollination have been located. One is a groundnesting anthophorid which seeks out extremely hard clay soil in which to nest. The megachilid nests in reeds and, like the xylocopid, appears to have a preference for east-facing locations. Tests to determine other nesting site preferences are in progress.

MYCONOGY

Identifications

A large number of requests for the identification of fungi associated with plants in various ways were received. These requests come

from workers at research institutes and other organisations within the Department, as well as from organisations and individuals outside the Department. More than 600 specimens were named.

Among the interesting and economically important fungi identified during the year were the following: *Alternaria raphani* on locally produced seed of Japanese radish; *Aspergillus clavatus* on sprouted maize used as fodder for dairy cows, and on spent Bantu beer wort used as cattle fodder; *Coniothyrium atriplicinum* on seeds of *Atriplex semibaccata*; *Colletotrichum graminicola* on maize plants from Bothaville and other parts of the Highveld; *Helminthosporium bicolor* as the cause of severe leaf spot of *Cenchrus ciliaris* pastures near Rustenburg; *Helminthosporium maydis* on maize from the Lydenburg district and also from Pietermaritzburg, Natal, where Race 0 of this fungus was identified on certain breeding strains and *Helminthosporium carbonum* on maize cobs from Carletonville and Clocolan as well as on maize leaves from Pietermaritzburg, Lydenburg, Rustenburg and Bothaville and many other localities in the maize belt.

Helminthosporium maydis, *H. carbonum*, *H. rostratum* and *H. cynodontis* were identified from maize seed. *Helminthosporium turcicum* was prevalent on maize throughout the maize-producing areas.

Phoma arachidicola, the cause of leaf blotch of groundnuts, was found on plants from the Brits district for the first time. Leaf rust of groundnut, caused by the rust fungus *Puccinia arachidis*, was identified for the first time on the same plants. This appears to be the first record of the occurrence of this fungus in South Africa.

Septoria digitalis was identified on cultivated *Digitalis* plants from Pretoria, and *Septoria helianthi*, the cause of the leaf spot of sunflower, was recorded from the Western Transvaal. *Alternaria zinniae*, which also causes a leaf spot of sunflower, was found in the same area for the first time.

A *Phoma* sp. was found on the stems of plants from which cuttings had been taken for export. These cuttings had been refused entry into Europe because European plant quarantine authorities had found *Ascochyta chrysanthemi* on them. *Ascochyta chrysanthemi* has hitherto not been recorded in South Africa.

Other interesting fungi identified included the puff ball *Mycenastrum corium*, suspected of causing poisoning of cattle, *Periconia saraswatipurensis* on grass from Stellenbosch, and *Sphacelotheca puppophori* on *Schmidtia kalahariensis*.

Curatorial work

Thirty-four specimens were added to the Herbarium, which now houses 44 965 specimens of fungi. The new additions represent specimens of

fungi found in South Africa for the first time or that are economically important and of scientific interest.

A total of 22 herbarium specimens had been sent on loan for study to overseas workers. Forty-seven specimens of the genus *Ganoderma*, which had been on loan to Dr R.L. Steyaert of Belgium, were returned by him, together with very valuable illustrations and comments on the specimens, and names for a number which had not been named before.

Ten cultures of fungi were sent to overseas authorities for naming and comments.

Research programme

Apart from the identification of fungi which frequently involved a considerable amount of research in the form of consultations of the literature and comparative morphological studies of the fungi in pure culture, a considerable amount of research had been carried out on different projects registered for the Mycology Section.

Seed-borne fungi and seed-borne fungal diseases in South Africa - A total of 26 samples of onion seed were examined for the presence of seedborne fungi. Eleven samples were of seed produced during 1973/74 by growers in different parts of South Africa.

The fungi present were the same species found previously and included *Fusarium moniliforme*, *F. equiseti*, *Botrytis alii*, *Botrytis cinerea* and *Stemphylium botryosum* as the important pathogenic species. *Alternaria porri*, the cause of purple blotch, was not found on the seed this year.

This work has been stopped since a sufficient number of samples have been examined to give a true record of the mycoflora of onion seed in South Africa. The results are being compiled and collated in preparation for publication.

Research activity in this programme had increased with the appointment of a Senior Professional Officer to work in this field. He started preliminary investigations of the seed-borne pathogens of locally produced Japanese radish seed, which is subject to poor germination and high seedling malformation and mortality, possibly owing to fungal infection of the seed. *Alternaria raphani*, a virulent pathogen of radish, has been found on a fair percentage of weak seedlings.

A number of samples of seeds of different kinds had been examined for specific fungi. These included seed of the silverleaf bitter apple, *Solanum elaeagnifolium*, salt bush seed *Atriplex semibaccata*, on which the fungus *Coniothyrium atriplicinum* was found, seeds of *Silybum* sp. on which *Alternaria alternata* was the dominant fungus, and maize seed on some of which low infections of *Helminthosporium maydis* were recorded.

Edible, inedible and poisonous mushrooms and toadstools - Although good rains fell during the season, very few mushrooms appeared. Only a small number of the more common edible species were brought in for identification.

Good specimens of the inedible species

Amanita strobiliformis were collected from a Pretoria garden. These were photographed and described for incorporation into the compilation of species intended for future publication.

Toxin-producing fungi in stock feeds

Phomopsis leptostromiformis - Pure cultures of this fungus, the causal organism of lupinosis in sheep, were prepared on sterilised maize kernels, then dried and handed to the Veterinary Research Institute for chemical analysis of the toxin.

Studies of the possible role of toxin-producing fungi on natural grazing and artificial pastures were continued. No correlation was found between changes in the mycoflora of a field of wheat stubble and *Panicum* sp. grass and the onset of photosensitivity in sheep grazing in this field, because of adverse climatic conditions. Valuable information on the composition of the mycoflora was obtained and one of the dominant fungi, *Phoma insidiosa*, was used in toxicity tests with sheep. Sterilised maize inoculated with this fungus and fed to a sheep caused mild elevation of serum glutamic oxalacetic transaminase, but no facial eczema or other signs of illness.

From specimens of *Tribulus terrestris* collected from a camp in which an outbreak of geeldikkop had occurred at Grootfontein, SWA, *Pithomyces chartarum* was isolated repeatedly. These isolates are being tested for their ability to produce sporidesmin.

Aspergillus clavatus was isolated from a specimen of spent Bantu beer wort which was shown to be toxic to cattle and identified as the dominant fungus. Isolates of this fungus were cultured on sterilised spent beer wort and fed to a young bull, which then developed the same symptoms observed in the poisoned cattle, thus proving the toxigenic nature of this fungus.

A further 200 kg of spent Bantu beer wort were sterilised and inoculated with this isolate of *Aspergillus clavatus* and handed to the Toxicology Section of the Veterinary Research Institute for chemical study of the toxic principle.

LEGUME RESEARCH

During the past season the Plant Protection Research Institute again selected *Rhizobium* bacteria for the chief types of legumes grown in South Africa and supplied them to manufacturers of inoculants. Strict control over the quality of the inoculant was maintained - only inoculants containing a minimum of 100 million bacteria per gram were permitted to be marketed.

The inoculants produced in sterilised peat in the Republic at present are of outstanding quality and are better than those produced in most overseas countries.

Apart from inoculants available commercially, 74 inoculants for a large variety of legumes that are not widely grown were supplied this year to farmers or research bodies for experimental purposes. This service is available to all bodies intending to undertake trials with new legumes.

A great deal of progress was made with the selection of suitable *Rhizobium* bacteria that effectively fix nitrogen in rooibos tea *Aspalathus linearis*. An inoculant for the crop will probably be prepared next year if there is sufficient demand.

CHEMICAL ANALYSIS SERVICES

On behalf of Institutes and Regions of the Department, Semi-Government organizations and farmers 19 764 plant, soil and water samples were analysed at the Soil and Irrigation Research Institute, on which 64 650 determinations were made.

In terms of Act 36 of 1947, samples totalling 2 343 were taken at all stockfeed factories, mills, fertilizer factories, agricultural lime cuttings and agricultural stock remedy manufacturers and analysed in the laboratories of the Soil and Irrigation Research Institute.

Approximately 97 per cent of these samples were found to conform to requirements.

**AGRICULTURAL TECHNICAL
RELATIONS WITH FOREIGN
COUNTRIES**

CO-OPERATION WITH AFRICAN COUNTRIES

Conferences and meetings attended in African countries

Nature of meeting	Time	Place	SA Delegates
SARCCUS Standing committee for animal production	16-18/7/74	Mozambique	Dr L. Mostert
			Prof J.A. Groenewald
SARCCUS Standing committee for animal health	16-18/7/74	Mozambique	Dr P.R. Mansvelt
			Dr J.P. van der Merwe

SARCCUS Subcommittee for land use planning and farm management	15-19/7/74	Swaziland	Dr D.M. Scotney
SARCCUS Standing committee for animal health and animal production	15-19/7/74	Mozambique	Dr J.G. Cloete
SARCCUS Subcommittee for run-off control and planning	15-19/7/74	Swaziland	Mr H.S. Niehaus
Symposium on beef, Salisbury	5/8/74	Rhodesia	Dr G.O. Harwin
Annual Congress of the Rhodesian Veterinary Association	11-13/12/74	Rhodesia	Dr P.P. Bosman
ERTS Programme	10-14/2/75	Malawi	Dr D. Edwards

Visitors from African countries

Name of visitor	Country of origin, institution to which attached	Period of visit	Purpose of visit	Institutions visited
Mr Bevan	Agric. Research Station, Maseru, Lesotho	2/10/74	To discuss the cultivation of maize, potatoes, soya-beans and lucerne	OFS Region
Mr W.F. Fisher	University of Botswana, Lesotho and Swaziland	4-11/10/74	Discussions on soil conservation and irrigation	OFS Region
Mr J. Forest	Leribe Project, Lesotho	21/11/74	To discuss the cultivation of potatoes and storage without cold storage facilities	OFS Region
Mr D. Hobbs	Rhodesian Seed Maize Association, Rhodesia	28/1/75	To discuss hybrid maize seed production and the registration of Rhodesian hybrids in the RSA	Division of Plant and Seed Control
Dr Klastrup	Dept. of Veterinary Services, Malawi	11-18/11/74	To discuss veterinary problems	Onderstepoort
Dr V.R. Simpson	Veterinary Services, Botswana	July 74	Discussions with officers of the virology division	Onderstepoort
Dr J. Falconer & Dr S. Walshe	Veterinary Services, Botswana	13/5/75	To discuss matters arising from the proposed veterinary agreement between SA and Botswana	Division of Veterinary Services
Mr D.F. Lovemore and Mr P. Bax	Veterinary Services, Rhodesia	10/4/75	Discussions on tsetse fly control	Division of Veterinary Services
Mr M. Cassidy	Dept. of Agriculture, Swaziland	13/1/75	To discuss potato certification	Division of Plant and Seed Control
Mr T. Maxwell and Mr B. Mwanda	Committee members of the Nat. Marketing Board, Zambia	28/1/75	Discussion on seed potato exports to Zambia	Division of Plant and Seed Control

Visitors to African countries

Purpose of visit	Date	Place	SA Officer(s)
To deliver lectures on soya-beans and groundnuts	17-19/7/74	Lesotho	Dr J.W. Snyman Mr C.J. Hunlun
To visit the Henderson Research Station, at the invitation of the Rhodesia Charolais Society	6/8/74	Rhodesia	Dr G.O. Harwin
To visit an agricultural project in Réunion	22/9-8/10/74	Réunion	Dr J.M. Erasmus Dr D.M. Scotney Mr D.F. de Wet

To judge the Simmenthalers at the Salisbury Show	27-31/8/74	Rhodesia	Mr H.S.J. Gehle
Discussions on cotton cultivation	Aug. 1974	Rhodesia	Dr H.G. van Heerden
Discussions with Swaziland authorities on the control of stock diseases and the movement of animals and animal products over the border	4/9/74	Swaziland	Dr P.R. Mansvelt
			Dr J.P. van der Merwe Dr J.M. Erasmus
To present a sheep and wool course at Mokhotlong	Sept. 74	Lesotho	Mr I.J.H. du Plessis
To assist with the planning of agricultural engineering for the period 1975-1984, at the invitation of the Rhodesian Minister of Agriculture	9/9-18/9/74	Rhodesia	Mr J.J. Bruwer
To assist with a survey on the control of the water weed <i>Salvinia</i>	9-11/12/74	Botswana	Mr I.D. Hattingh
To visit Dr I.B. Edwards to prepare a draft plant for liaison and co-operation on the proposed establishment of a wheat screening nursery in the RSA	23-25/3/75	Rhodesia	Dr D.J. Rossouw
Study tour as members of the Cotton Action Committee to undertake a study of the cultivation and grading of cotton	April 75	Rhodesia	Dr H.G. van Heerden Mr J.J. v.d. Merwe Mr C.J. Theron Mr J. de Kock
To investigate the initiation and expansion of the wheat industry in the light of the environmental conditions and the organisation	19/5-27/5/75	Malawi	Prof S.A. Hulme Dr C.N. MacVicar
To attend the opening of the Marandellas factory and inspect several abattoirs after the opening	1-8/5/75	Rhodesia	Dr J.H.B. Viljoen Dr J.P. v.d. Merwe Dr P.R. Mansvelt

VISITORS TO OVERSEAS COUNTRIES

Congresses, meetings and symposia

Nature of meeting	Time	Place	SA Delegate
17th Congress of the International Seed Testing Association and the advisory group of the Organisation for Economic Co-operation and Development	10/6-6/7/74	Paris	Mr J.F. van Wyk
Annual meeting of the seed certification authorities of the Organisation for Economic Co-operation and Development	Oct. 1974	Paris	Mr J.F. van Wyk
ditto	ditto	ditto	Mr L.J. Grobler
Annual congress of the International Society for Horticultural Science (ISHS) in Warsaw	11-18/9/74	Poland	Dr J.C. Strydom
ditto	ditto	ditto	Dr J.T. Meynhardt

Twentieth European meeting of the Meat Research Workers	15/9-20/9/74	Ireland	Mr R.T. Naudé
Congress of the European Association of Animal Production	17/8-21/8/74	France	Mr R.T. Naudé
Congress on ecosystem research	7/9-30/9/74	Holland	Dr B. de Winter
AETFAT congress on ecology	ditto	Switzerland	ditto
Fourth international symposium on the physiology of the ruminant, visits to laboratories and universities	15/8-20/9/74	Australia	Dr F.M.C. Gilchrist
Second international drip irrigation congress in San Diego	July 1974	USA	Dr A. Streutker
ditto	July 74	USA	Mr W.J. Uys
54th Meeting of the International Wine Office (OIV)	16-22/9/74	Italy	Dr J.D. Burger
Sixth international sunflower congress in Bucharest	22/7-11/8/74	Romania	Mr W.J. Vermeulen
Eighth international congress on agricultural engineering in Flevehof	17/9-7/10/74	The Netherlands	Mr J. Veenstra
First international symposium on protein metabolism and nutrition in Nottingham	8-12/7/74	England	Mr W.D. Basson
Third international congress on pesticide chemistry in Helsinki	3-9/7/74	Finland	Dr W.J. Pienaar
54th general meeting of the Wine Office and presentation of a paper on the irrigation of wine grapes	16-22/9/74	Italy	Mr D. Saayman
First international symposium on protein metabolism and nutrition in Nottingham	8-12/7/74	England	Mr R.I. Mackie
International congress on mycoplasma in Bordeaux	11-17/9/74	France	Mr J. Moll
14th Conference of the foot-and-mouth commission of the International Office of Epizootic Diseases in Paris	11-14/3/75	France	Dr A. Pini
Seventh international congress on plant analysis and fertiliser problems in Hanover	2-6/9/74	Germany	Dr J.H. Terblanche
ditto	ditto	ditto	Dr A.J. v.d. Merwe
International nematological symposium in Granada	1/9-8/9/74	Spain	Dr A.J. Meyer
Sixth meeting of the agricultural meteorology commission in Washington	Oct. 74	USA	Mr J. Myburgh
Fourth international congress on steroid hormones in Mexico City	Sept. 74	Mexico	Dr J.C. Morgenthal
Annual congress of the International Office of Epizootic Diseases (OIE)	May 75	France	Dr G.C. Dent
Second international food industry congress in London	May 1975	England	Dr B.K. Nortje
Seminar on the control of mastitis; visit to institutions for further study of this disease	4/4/75-5/5/75	England	Dr W.H. Giesecke
Symposium on insecticides in Wageningen	April 75	The Netherlands	Dr C.J. Howell
Symposium on blood parasites	17-22/3/75	Colombia	Dr A.J. de Vos
World tobacco symposium	May 1975	England	Mr H.G. Snyman
Second international winter wheat conference	9-19/6/75	Yugoslavia	Mr B. Lombard

STUDY TOURS AND OFFICIAL VISITS

Purpose of tour/visit	Date	Place	SA Officer(s)
To study latest techniques for plant seed quality control	Oct. 1974	Italy, Germany, the Netherlands, Sweden, UK, France	Mr L.J. Grobler

To gather information from research institutes and authoritative sources	Sept. 1974	Israel	Dr J.C. Strydom
To obtain information on flower and cherry research and make table grape selections	Sept. 1974	The Netherlands, Belgium, Spain, Germany, UK	Dr J.L. Meynhardt
Study of artificial pastures for the mediterranean climate	8/9-19/10/74	Australia, New Zealand	Mr C.J. Pienaar
To study citrus cultivation	15/8-5/10/74	Israel, Sicily, France, Spain, Corsica	Dr G.S. Bredell
Study of the efficiency of various methods and approaches that can be applied at different farming levels	9/10-11/10/74	UK, USA	Mr D.M. Rix
Study of overseas approach to species delimitation and variability in plants	Sept. 1974	Switzerland, the Netherlands, Germany, Denmark, Portugal	Dr B. de Winter
Study of aspects of soil classification, mapping and analysis	15/9-11/10/74	USA	Mr J.D. Basson
Study of the latest methods of beef production	14/9-17/10/74	USA	Dr M. von la Chevallerie
Research on internal parasites at overseas institutions	17/9-31/11/74	Germany, Switzerland, UK, USA, South America	Dr. J.A. van Wyk
Study of the analytical procedure for identifying insecticides and dips capable of causing poisoning in man and animal	1/7-12/8/74	UK, Sweden, Finland, Belgium, USA, South America	Mr J.A. Minne
Investigation of the planning and development of an irrigation project in South Dakota and irrigation research at Davis	July 74	USA	Dr A. Streutker
To visit universities and research institutes in order to study the latest research findings on drip irrigation, micro-irrigation and sprinkler irrigation	July 74	USA	Mr W.J. Uys
To study methods of data collection and processing with a view to planning and implementing adapted farming systems for homogeneous farming areas	16/8-30/9/74	USA, UK, the Netherlands, Germany	Mr D.J. Hattingh
Study tour on desert encroachment, pasture research, feeding systems, control of ligneous invader plants, inclusion of drought forage crops and general veld conservation and resource utilisation	5/8-31/8/74	USA	Dr P.W. Roux, Mr T.E. Skinner
Investigation into administration and organisation, application of legislation and procedures, and budgets and financial control of agricultural research organisations	5/10-17/11/74	UK, Europe	Mr B.W. Viljoen
Study of the latest developments in the field of tobacco research and extension	5/7-4/8/74	USA, Canada	Mr H.G. Snyman
Investigation of mechanisation systems in the USA	April-Oct. 1974	USA	Dr B.V.D. Boshoff
Investigation of several aspects of extension	June-Aug. 1974	The Netherlands, England, Germany, Italy	Dr N.J. Robberts

Investigation of the problem of pesticide residues in foodstuffs	July 1974	Finland, UK, the Netherlands, Germany, Switzerland, France	Dr W.J. Pienaar
Investigation into the methods of effecting optimum utilisation of agricultural resources	Sept. 1974	USA, England, the Netherlands, Germany	Dr W.J. Hugo
Study of certain aspects of the Departmental project on ecosystem research	Aug.-Sept. 1974	England	Mr M.C. Rutherford
Study of poultry feeding, with special emphasis on obtaining information on alternative sources of protein for poultry	July 1974	Germany, UK, the Netherlands	Mr J.H. de Jongh
To identify the problems experienced in ecosystem research, ascertain how these problems can be prevented and study the latest approaches in ecosystem research	6/7-14/9/74	Europe, USA, Canada, UK	Mr O.J.H. Bosch
To study advanced laboratory techniques in relation to the evaluation and utilisation of protein sources in Cambridge, under the guidance of Dr Carpenter; to view the facilities and techniques at other institutions	6/12/74-11/5/75	England, France, Germany, Switzerland, the Netherlands, Sweden, Denmark, Belgium	Mr G.A. Smith
Visits and interviews at several research and production stations	9/3-30/4/75	France, Spain, Italy, Germany, the Netherlands, Belgium, England	Dr A. Pini
To obtain information on soil analysis techniques, soil fertility matters and electro-ultrafiltration techniques	7-24/9/74	Germany, France, Belgium, the Netherlands, England	Dr A.J. v.d. Merwe
Technical tour arranged by the Pomological Association of SA	8/6-9/7/74	UK, Europe, Israel	Prof D.K. Strydom, Mr J. de V. Lötter
To conduct tests on a dangerous pathogen <i>Helminthosporium maydis</i> which has been observed on maize in the RSA	Aug. - Sept. 74	USA	Dr J.J. v.d. Watt
Study of methods of estimating banana crops	10/10/74- 13/1/75	Israel, France, Canary Islands	Mr F. Kühn
Collection of insects for the biological control of beetles and moths	30/12/74- 8/3/75	Australia	Dr S. Nesar
To accompany a group of pomologists as tour leader	Nov. 74	South America	Mr R.P. Fresno
Investigation into the use of protein and non-protein nitrogen and ruminants	2/12- 18/12/74	Germany, England, Belgium	Mr W.D. Basson
Investigation into grain drying, particularly drying with the aid of aeration	25/10/- 12/11/74	USA, Argentina	Mr C.T. Crosby, Mr. H.W.P.W. Strück
Study of the preservation of fruit and the composition of fruit drinks	May 1975	England, Switzerland, The Netherlands, Germany, Israel	Dr B.K. Nortje

To study the latest developments in no-tillage methods	June 1975	USA	Dr J.B. Mallet
Visits to veterinary institutions	April 75	Switzerland, Germany, England	Dr C.J. Howell
To interview Dr Otto Theimer who is known for his work on the DIN Standard	14-23/3/75	Germany	Mr D.J. Vaughan
To visit institutions in Germany and France in connection with the utilisation and processing of scrap tobacco	5/5-28/5/75	Germany, France	Mr H.G. Snyman
To accompany a delegation from the Canning Fruit Board to investigate the deciduous fruit canning industry in Spain	June/July 1975	Spain	Mr O. Bergh
21-day study tour (after the completion of the ACTIM course) to study a performance testing scheme	4/5-25/5/75	Sweden, Denmark, UK, the Netherlands, Belgium	Dr H.Q. Gray
To visit Israel as a guest of the Director of the Council for Research and Development in connection with liaison in the field of agricultural science	2/3-16/3/75	Israel	Dr W.A. Verbeek
To collect technical information on engineering and animal science	29/3-1/5/75	USA, UK, Sweden	Mr A.D. Heyl, Dr P.E. Lombard
To attend the <i>Grüne Woche</i> at the invitation of the "Centrale Marketing gesellschaft der Deutschen Agrarwirtschaft" in Berlin	Jan. 75	Germany	Mr D.B. Marais
To participate in the CIMMYT wheat breeding programme	21/2/75- 11/5/75	Mexico	Mr K.W. Pakendorf, Mr J.N.W. de Jager
To visit the Agricultural Counsellor in Paris (<i>en route</i> to Washington) to learn more about the functions of an agricultural counsellor	24/11- 30/11/74	France	Dr A.D. Venter
To study harmful predatory mites in horticultural crops	26/5- 27/6/75	England, the Netherlands, Germany, Switzerland	Dr M.K.D. Meyer
To investigate vegetable production and research, especially the standard of efficiency in production	4/4-24/4/75	Australia	Mr E. Strydom
Study of French beef breeds, for improving beef production: a 3 months' course in the French language	27/11/74- 30/4/75	France	Mr H.Q. Gray

The following table reflects the visits by officers of the Department to African and overseas countries, and the expenditure involved, during the past five financial years.

Attendance at symposia, congresses, etc. and study tours

Financial year	Visits to African States	Visits to overseas countries	Departmental expenditure	Funds provided by Boards and other bodies	Total expenditure
			R	R	R
1970/71	66	56	40 100	20 700 (a)	60 800
1971/72	51	75	45 100	18 600 (b)	63 700
1972/73	90	53	39 730	15 000 (d)	54 730

(Table continues)/

1973/74	56	62	60 610	30 380 (d)	90 990
1974/75	40	89	114 200	27 700 (e)	141 900

a Expenditure in respect of 24 officers not included since all costs were borne by the body that invited them and no figures are available.

b Ditto in respect of 19 officers

c Ditto in respect of 22 officers

d Ditto in respect of 19 officers

e Ditto in respect of 19 officers

Scientific and other visitors

Name of visitor	Country of origin, institution to which attached	Period of visit	Purpose of visit	Institutions visited
Dr Almquist and Dr H. Lagergren (Miss)	Sweden, Swedish Embassy	14/3/75	Discussion on sheep breeding and animal diseases in the RSA	Onderstepoort
Dr G.R. Varley with a touring group of 16	Australia	3/9/74	To gather information	Veterinary regional laboratory of the Division of Veterinary Services
at Middelburg, CP				
Group of 25 Belgian farmers (men and women)	Belgium	11/2/75	To acquire information	Onderstepoort
Dr Kurt Biegert	Animal production organisations of Baden-Württemberg, W. Germany	Sept. 1974	To award two gold medals to cattle breeders at show	Pretoria Show and Animal and Dairy Science Research Institute
Dr N. Borlaug	Centre International de Mejoramiento de Maiz Y Trigo, Mexico	29/9-11/10/74	Discussions with wheat breeders and persons involved in the wheat industry	Roodeplaat, Bethlehem and Vaalharts Research Stations
Mr J. Braak	Director ZBC Holland	28/1/75	Discussion of legislation with regard to plant breeders' rights in RSA	Division of Plant and Seed Control
Dr Caenellatti	Virology, University of Padua, Italy	10 days Sept. 74	To investigate problems in connection with bluetongue, elephant skin disease,	
heartwater, etc.				Onderstepoort
Mr B.W. Carey	Dept. of Primary Industries, Australia	12/10-25/10/74	To investigate methods of farm planning with a view to soil conservation and other matters, such as grazing control, erosion control, etc.	Division of Soil Protection, Soil and Irrigation Research Institute, Highveld and OFS Regions
Mr P. Coca	Firma Bungo Bonn SA, Argentina	3 weeks July 74	To gather information on subtropical grass species, beef breeds, cotton and soya-beans	Transvaal Region, Crops and Pastures Research Institute, Animal and Dairy Science Research Institute and Citrus and Subtropical Fruit Research Institute

Mr B. Crack	Agric. Chem. Branch Queensland State Dept. of Primary Industries, Australia	9-10/9/74	To take part in discussions on soil fertility, soil testing and environmental control, and gather information on the International Soils Congress in Moscow	Soil and Irrigation Research Institute
Dr Basil Daris	Zykovrissi-Amaroussio Wine Institute, Greece	March 1975	To assist with various matters, including plans for using herbicides in vineyards and the breeding of seedless grapes	Fruit and Fruit Technology Research Institute
Dr A. Erez	Botanical Institute, Department of Agriculture, Israel	20/ 10-25/ 10/ 74	Discussions on fruit and wine cultivation	Fruit and Fruit Technology Research Institute and Viticultural Research Institute
Messrs P Berucount, J.T. Mewlin, F. Hanicolte and H. Tesse	Lille, France	8/8/74	To discuss veterinary matters	Regional veterinary laboratory of the Division of Veterinary Services, Middelburg, CP
Prof D. Goeden	California, USA	18/3-25/3/75	Biological weed control (cactus)	Eastern Cape Region
Mr J.L. Guillerm	Centre d'Etudes Phytotoxicologiques et Ecologiques (CEPE), Montpellier, France	22/ 1-24/2/75	Research under the scientists exchange scheme (between the RSA and France), in co-operation with officers of the Botanical Research Institute	Botanical Research Institute
Dr P.R. Harvey	Chief Vet. Officer, Dept. of Agriculture, Adelaide, Australia	1/8-6/8/74	Discussions on the control of brucellosis and tuberculosis	Onderstepoort and Division of Veterinary Services
Dr R.O. Heinonen	German Agency for Technical Co-operation, Germany	March 1975	To gain experience at the Pathology Dept., Onderstepoort	Onderstepoort
Prof W. Horn	University of Hanover, Germany	July 1974	To collect information on the vegetable, fruit and commercial flower industries	Horticultural Research Institute and Fruit and Fruit Technology Research Institute
Dr P. Huglin	Director, Oenology and Viticulture, Colmar, France	Six weeks, from 20 Jan. 1975	To give advice on ecological matters in relation to viticulture and the adaptation of cultivars	Oenological and Viticultural Research Institute
Mr and Mrs P. Lamour	President of the <i>Bas-Rhône Languedoc</i> Development Company, France	1-18 3 75	To visit SA as a guest of the Department	Minister, Secretary, Chief Directors, Fruit and Fruit Technology Research Institute, Oenological and Viticultural Research Institute, Ditrus and Subtropical Fruit Research Institute, etc.
Study group	Center for Continuing Education, US Dept. of Agriculture, USA	Feb.-March 1975	Educational tour	Head Office and several institutes of the Department

Prof J.R. Larrosa Borean	Sheep production and technology, University of Uruguay, Uruguay	3-17/7/74	To study the latest developments in research by the Dept. on sheep and wool production	Animal and Dairy Science Research Institute, Onderstepoort and the Karoo Region
Dr P. Leclercq	Head of French sunflower breeding programme (INRA), France	1-8/1/75	To visit plantings of sunflower breeding strains carried out in co-operation with OTK to assist the Dept. with its local programme	Crops and Pastures Research Institute, Division of Plant and Seed Control and the Highveld Region
Mr F. Logemann, Deputy Minister of Agriculture, Dr R.H. Messerschmidt and Mr K. Rath	Germany	14-20/11/74	To visit SA as the guests of the Department of Foreign Affairs	Minister, Secretary, Onderstepoort, Animal and Dairy Science Research Institute and Citrus and Subtropical Fruit Research Institute
Dr D. McCloud	Programme co-ordinator of the international groundnut programme, Florida, USA	11/1-15/1/75	To find collaborators for the international groundnut programme, with the aim of developing better cultivars	Crops and Pastures Research Institute
Dr R. Menary	Specialist in leaf analysis and feeding requirements of bananas, Australia	Aug. 1974	Discussions on research on leaf analysis, etc. for bananas	Citrus and Subtropical Fruit Research Institute
Nebraska Agricultural and Livestock Dealers Goodwill Delegation (21 persons)	USA	12/2/75	To gather information on veterinary problems	Onderstepoort
Dr Averal	USA	21/2/75	To make arrangements for the collection of ticks	Natal Region (Dr Averal is a temporary lecturer at the University of Natal)
Mr J. Radaritz	Germany	24/1/75	Discussions on the production of pea seed exported to SA on behalf of his firm	
firm				Division of Plant and Seed Control
Dr G. Rapp & Company	Agric. Educ. Foundation, Davis, California, USA	Jan. 1975	To gather information on land use and soil conservation methods	Head Office and Division of Soil Protection
Dr M.E. Raw	England	3/2/75	To observe activities at the Institutes	Onderstepoort
Mr & Mrs J.E. Tabor	England	20/1/75	To learn more about animal diseases	Onderstepoort

Mr W. Thomas	New Zealand	23/12-31/12/74	To investigate parasites of the black maize beetle	Eastern Cape Region
Touring group from Uruguay	Uruguay	11/7/74	Educational visit	Regional veterinary laboratory, Middelburg, CP
Touring group of 34 men and women (stock and grain farmers)	Canada	7/2/75	Educational tour	Onderstepoort
Mr L. Winks	Dept. of Primary Industries, Australia	1/7-17/7/74	To make a study of animal feeding and animal production (cattle), dry season feeding, etc.	Natal, Transvaal, E. Cape, Highveld and SWA Regions
Dr I.G. Wright	Division of Animal Health, Long Pocket, Laboratoria, Queensland, Australia	Oct. 74	To discuss veterinary matters	Onderstepoort
Prof P. Charlet	France	2/4-19/4/75	To attend the congress of the SA Society of Animal Production and visit certain institutions	Karoo, Transvaal and OFS Regions and the Animal and Dairy Science Research Institute
Mr B. Lambert	Director of several breeders' associations, France	21/4-30/4/75	To attend the international Brown Swiss Cattle Breeders' Conference and visit Departmental institutions	Free State and Transvaal Regions and the Animal and Dairy Science Research Institute
Mr F. Patenotre	President of the Brown Swiss Breeders' Association, France		ditto	ditto
Mr F. Levacher	President of the Ile-de-France Breeders' Association, France		ditto	ditto
Messrs J.A. Moss, A.E. Tims and A. McDonald	British Semen Export and Overseas Servicing of the Milk Marketing Board, England	18/4/75	Discussions on imports of cattle and pork semen	Division of Veterinary Services
Dr M.E. Nairn	Department of Agriculture, Australia	13/6/75	To exchange information on several aspects of caseous lymphadenitis (CLA) in sheep with Dr C. Cameron	Onderstepoort
Touring group consisting of members of the Brown Swiss Breeders' Association	USA, Austria and Switzerland	15/4/75	Educational	Onderstepoort

Mr Sheng Feh Lee	Ministry of Economic Affairs, Taiwan	25/4/75	Discussions on veterinary matters and meat hygiene in relation to red meat for export to Taiwan	Division of Veterinary Services
Mrs C. Thorogood	Breeder of stud horses and member of the Angora Goat and Mohair Association of Australia	1/5/75	To study Angora goats	Onderstepoort
Dr H.A. Dumont and Dr M.G. Gauthier	Veterinary science organisation of Réunion	24/4-18/5/75 24/4-11/5/75	Study in connection with a cattle farming project in Réunion	Division of Veterinary Services
Mr Orlin	Technical marketing director, Hazera Seeds, Israel	3/4/75	To discuss the certification of vegetable seed and cotton seed	Division of Plant and Seed Control

INTERNATIONAL ORGANISATIONS

The Department is a member of, or participates in the activities of, the following organisations:

- 1 International Standards Organisation (ISO)
- 2 International Biological Programme of the International Council for Scientific Unions (ICSU)
- 3 International Seed Testing Association (ISTA)
- 4 International Scheme for the Certification of Forage Crop Seed of the Organisation for Economic Co-operation and Development (OECD)
- 5 International Society for Horticultural Science (ISHS)
- 6 International Dairy Federation (IDF)
- 7 International Society for Animal Blood Group Research (ISABR)
- 8 Centre for Co-operation in respect of Scientific Research on Tobacco (CORESTA)
- 9 International Commission of Agricultural Engineers (CIGR)
- 10 International Wine Office (OIV)
- 11 The food irradiation project under the auspices of the International Atomic Energy Agency (IAEA) and the European Nuclear Energy Agency (ENEA)
- 12 International Office of Epizootic Diseases (OIE)
- 13 International Institute for Refrigeration (IIR)
- 14 International Organisation for Biological Control (IOBC)
- 15 Pea Growers' Research Organisation Ltd. (PGRO)
- 16 Tea Research Foundation for Central Africa
- 17 Southern Africa Regional Commission for the Conservation and Utilisation of the Soil (SARCCUS)
- 18 International Association for Plant Taxonomy and Nomenclature
- 19 Centraalbureau voor Schimmelcultures
- 20 International Association for the Mechanisation of Field Experiments (IAMFE)
- 21 Commonwealth Mycological Institute
- 22 Union for the Protection of New Plant Varieties (UPOV)
- 23 International Plant Protection Convention (IPPC)
- 24 International Seed Merchants' Association (FIS)

REPRESENTATION ABROAD

The following table gives statistical particulars of the activities of the various overseas representatives of the Department during the year under review.

Nature of activities	Europe Paris	London	Washington	Buenos Aires	Canberra
1. Visits to research institutes, farms, experimental farms, etc.	143	16	50	60	37
2. Conferences and meetings attended	31	12	14	23	3

3. Special investigations reported on	115 (16 of which took the form of special reports or leading articles in newsletters)	2	84	9	3
4. Reports and publications supplied to the Department and other organisations in the RSA	3 679	332	5 078	115	272
5. Number of visitors from South Africa:					
(a) for whom itineraries were drawn up and the main arrangements made	117	34	31	55	4
(b) to whom general assistance was given	170	80	13	91	6
6. Interviews granted to non-South Africans	102	51	13	225	7
7. Bursary students and other South African students assisted	1	4	19	2	
8. Material consigned to South Africa -					
(a) plant material (number of cultivars and/or individual seed samples)	103	50	2 455	89	36
(b) animal material	50 sheep 2 550 units of bull semen	832 animals			
9. Newsletters compiled and sent to the Department	13 (in the form of "Agricultural Report, Europe" (together with London)		29	4	9

ADMINISTRATIVE MATTERS

ESTABLISHMENT

Posts

The following table shows the number of posts in the Department, and the number of vacancies in each Division, at 30 June 1975. (Figures for the corresponding period of the previous year are also given.)

Division	30/6/1974			30/6/1975		
	Authorised Posts	Vacant Posts		Authorised posts	Vacant Posts	
		Number	%		Number	%
Administrative	155	12	7,7	164	9	5,5
Clerical	478	56	11,7	481	32	6,7
Professional	1 583	212	13,4	1 494	190	12,7
Technical	1 566	203	13,0	1 586	31	2,0
General A	86	3	3,5	85	2	2,4
General B	2 324	300	12,9	2 216	209	9,4
Non-classified	174	125	7,2	171	8	4,7
Posts additional to the authorised establishment	105	70	66,7	107	88	82,2
Total	6 471	981	15,2	6 304	569	9,0

Increase/decrease in the number of authorised posts in the various categories over the past 5 years:

Division	30.6.71	30.6.72	30.6.73	30.6.74	30.6.75	Total % increase or decrease
Administrative	132	135	145	155	164	→24,2
Clerical	468	465	475	478	481	→ 2,8
Professional	1 719	1 715	1 691	1 583	1 494	- 13,1
Technical	1 550	1 534	1 544	1 566	1 586	→ 2,3
General A	87	86	86	86	85	- 2,3
General B	2 239	2 296	2 221	2 324	2 216	- 1,0
Non-classified	326	323	286	174	171	- 47,5
Total	6 521	6 554	6 448	6 366	6 197	- 5,0*

*Note: The decrease in the number of authorised posts may be ascribed to the annual reduction in vacancies in the entry grade, in accordance with the economy measures laid down by the Cabinet, the re-allocation of services to other bodies, and the application of production control techniques

P.s.: Non-classified posts do not include posts additional to the establishment.

GENERAL

The following measures relating to increases in the establishment were put into operation on 1 April 1975 by the Cabinet:

- Funds were allocated for ordinary and extraordinary expansion of the establishment.
- Organisational and establishment inspections were suspended except in urgent and essential *ad hoc* cases.
- The short-term control technique is no longer used throughout the Department.

In the clerical field, however, the creation of posts is still subject to this technique and the findings arrived at in terms of it.

IMPORTANT ORGANISATIONAL AND ESTABLISHMENT CHANGES

1. The establishment of the Division of Veterinary Services was expanded to make provision, under the Animal Slaughter, Meat and Animal Products Hygiene Act, for the rendering of meat inspection services at the following abattoirs:

Johannesburg: 1 July 1974

Durban: 1 January 1975

2. Internal re-organisation took place in the Division of Veterinary Services (Winter Rainfall Region) and at the Plant Protection Research Institute on 1 August 1974 and 1 March 1975 respectively, in order to adapt the provision of authorised posts at these establishments to changed service requirements.

3. The Faculties of Agriculture at Stellenbosch and Bloemfontein were abolished on 1 January 1975. The lecturers and technical staff of these faculties were transferred to the Universities of Stellenbosch and the Orange Free State from this date.

4. A documentation section was established at the Information Bureau of the Division of Agricultural Information with effect from 1 February 1975.

5. A Regional Engineering Services Section to serve the South-West African Region, was created on the establishment of the Division of Agricultural Engineering with effect from 1 March 1975.

6. In order to spread managerial responsibility in the Administration Branch more evenly, the staff and General Division was re-organised with effect from 1 March 1975 and divided into two independent divisions, viz Auxiliary Services and Staff and Training, each of which is controlled by a Deputy Secretary.

7. As a result of the implementation of the system of target budgeting, the Finance Sections of the Division of Agricultural Engineering (Winter Rainfall Region) and the Citrus and Sub-tropical Fruit, Tobacco, and Animal and Dairy Science Research Institutes were suitably reinforced with effect from 1 March 1975.

8. The Department's overseas service in Western Europe was placed under the overall professional control of a Principal Counsellor (Agricultural Technical) on 1 May 1975.

Staff gains and losses

Division	1.7.73 - 30.6.74			1.7.74 - 30.6.75		
	†Gains	*Losses	%	†Gains	*Losses	%
Administrative	7	12	-71,4	6	15	- 150,0
Clerical	41	50	-22,0	162	150	+ 7,4
Professional	123	223	-81,3	148	218	- 47,3
Technical	124	221	-78,2	331	270	+ 18,4
General A	9	15	-66,7	12	12	
General B	680	707	- 4,0	751	720	+ 6,5
Non-classified	41	64	-56,1	92	90	+ 2,2
Total	1 025	1 292	-26,0	1 502	1 457	+ 3,0

† By "Gains" is meant all persons gained by every Division, i.e. appointments from outside, promotions and translations from one Division to another, and transfers from other Departments.

* By "Losses" is meant all persons lost by various Divisions (individually or jointly), including translations and promotions to other Divisions and cases where persons left the service for good, such as resignations, deaths, retirements, absences and dismissals.

Staff changes (Senior staff)

RETIREMENTS

The following senior officers retired from the service of the Department after a long career, on reaching the age limit:

Name	Rank	Institution to which attached	Years of service	Date of leaving the service
Dr C.M. van Wyk	Chief Director (Animal and Dairy Science)	Directorate of Agricultural Technical Services	39 years	30.11.74
Mr L.C. Zeeman	Director	Natal Region	16 years	30.11.74
Mr D.J. Louw	Director	South-West Africa Region	40 years	30. 6.75
Mr E.C. Anderssen	Deputy Director (Extension)	Transvaal Region	23 years	31. 5.75
Dr H.L. Pearse	Assistant Director	Horticultural Research Institute	34 years	31.10.74
Dr G.C. v. Drimmelen	Assistant Director	Division of Veterinary Services	41 years	28. 2.75
Mr P.F.H. Clarke	Assistant Director	Crops and Pastures Institute	28 years	31. 3.75

PROMOTIONS

Name	Rank to which promoted	Institution	Date promotion became effective
Dr D.W. Immelman	Senior Deputy Secretary (Professional Development)	Head Office Management	1.11.74
Dr D.J. Agenbach	Chief Director (Farm and Resources)	Directorate of Agricultural Technical Services.	1. 2.75
Dr P. Hildyard	Director	Natal Region	1.12.74
Dr J.D. Slabber	Director	Highveld Region	1.12.74
Dr J.M. Erasmus	Deputy Director	Division of Veterinary Services	1. 4.75
Mr S.J. Gericke	Deputy Director (Extension)	Transvaal Region	1. 6.75
Mr M.S. le Roux	Deputy Director	Oenological and Viticultural Research Institute	1. 7.74
Mr H.G. Snyman	Deputy Director	Tobacco Research Institute	1. 8.74
Dr P.P. Bosman	Assistant Director	Division of Veterinary Services	1. 4.75

BURSARIES

The bursary scheme administered by the Department with funds donated by the various control boards was continued during 1974/75. Bursaries are awarded for the full period of study, which may vary from one year to four years.

The following table shows the number of bursaries awarded since 1971, and their monetary value:

Number of bursaries

	New grants	Total	Studies completed	Total monetary value of new bursaries awarded (R)
Grants up to 1971	29	138	23	61 600
Grants up to 1972	34	149	25	59 200
Grants up to 1973	46	170	32	98 200
Grants up to 1974	33	171	24	77 600
Grants up to 1975	45	192	28	118 000

Bursaries awarded for post-graduate study at local universities up to and including 1975 are included in the table. During 1975 five bursaries (total value R5 000) were awarded for post-graduate study at local universities.

The following table shows the number of officers released from service for post-graduate study at local universities since 1971:

Year	1971	1972	1973	1974	1975
B.Agric.(Hons) (Inst./ Agrar.)	8	14	12	6	7
B.Sc. (Agric.) (Hons)					38
Master's Degree	47	40	39	31	
Doctorate			1		

As regards advanced scientific training, a number of promising officers are studying abroad. The number of officers sent abroad for post-graduate study is decreasing.

The following table shows the number of officers who have completed their overseas studies since 1971 or will complete them shortly:

Year	1971	1972	1973	1974	1975	1976
Number	4	4	5	5	5	1

A sum of R4 460 was granted to 21 needy students taking the diploma course at the various colleges of agriculture.

TRAINING OF AGRICULTURAL TECHNICIANS

The training of learner technicians was transferred to the Pretoria College for Advanced Technical Education as of 4 July 1972. An induction course was arranged for the first-year learner technicians during the first semester of 1975.

10. Annexures

(1) ORGANISATION AND FUNCTION OF THE DEPARTMENT

(a) HEAD OFFICE OF THE DEPARTMENT

Agriculture Building, cor. Beatrix Street and Soutpansberg Road, Private Bag X116, Pretoria, 0001.

Overhead Administrative Control

Secretary - Dr W.A. Verbeek
Senior Deputy Secretary (Professional) - Dr D.W. Immelman
Senior Deputy Secretary (Administrative) - Mr B.W. Viljoen
Deputy Secretary (General Auxiliary Services) - Mr R.W. Colenbrander
Deputy Secretary (Personnel and Training) - Mr A.J. Schoonwinkel
Deputy Secretary (Technical and Legal Affairs) - Mr L.J. Botha
Under-Secretary (Sundry) - Mr J.E. Carstens
Under-Secretary (Personnel Administration) - Mr P.M.A. Spreeth
Chief Work Study Officer - Mr G.P. Kleinhans
Under-Secretary (Data Processing) - Mr G.J. Smit
Under-Secretary (Technical Administration) - Mr A.C. Bosch
Under-Secretary (Statutory Control) - Mr C.J. Wessels
Under-Secretary (Acts and Parliamentary) - Mr C.S. de Villiers
Under-Secretary (External Affairs) - Mr V.M. Stewart
Under-Secretary (Programme Planning and Estimates) - Mr H.F. van Zyl
Chief Accountant - Mr P.B. de Klerk
Assistant Chief Accountant - Mr P.L. Joubert
Assistant Chief Accountant (Programme Planning and Estimates) - Mr J.J. Lombard

Directorate of Agricultural Technical Services

Chief Director (Crops and Pastures) - Prof. S.A. Hulme
Chief Director (Farm and Resources Development) - Dr D.J. Agenbach
Chief Director (Horticulture) - Dr J.C. Strydom
Chief Director (Animal and Dairy Science) - Vacant
Chief Director (Extension and Education) - Mr S.W. Walters

Veterinary Services Branch

Chief Director (Veterinary Services) - Dr B.C. Jansen
Assistant Director (Administrative) - Mr M.D. Meyer (Transvaal Agricultural Union Building, 281 Struben Street, Pretoria, 0002)

Panel Professional Auxiliary Services

Director - Mr A.B. Bridgens (Deputy Director)
Deputy Director (Biometry) - Vacant
Assistant Director (Biometry) - Dr J.P. Jooste
Assistant Director (Training) - Mr J.C.D. Retief (Division of Agricultural Information)
Assistant Director (General Auxiliary Services): Mr E. Verster (Soil and Irrigation Research Institute)

Crops and Pastures Institute

Director - Dr A.J. Pienaar
Deputy Secretary - Mr D.F. de Wet
Assistant Directors: Mr T.E. Skinner, Dr D.J. Rossouw and Dr J.W. Snyman

The Institute does not itself engage in research but gives guidance to research workers engaged in research in the different regions on summer grain, winter grain, other agricultural crops, pastures and pasture crops, and co-ordinates all research in this connection. The co-ordination of weed and poisonous plants research at the national level, as well as supplying technical information in connection with weedicides, is also a function of the Institute.

Departmental Inspectorate

Departmental Inspector (Professional) - Mr H.J. Kriek

(b) FOREIGN REPRESENTATIVES

Agricultural Attaché (London) - Mr C.S. Hawkins (Agricultural Counsellor) (South African Embassy, South Africa House, Trafalgar Square, London W.C.2N5DP, England)
Agricultural Attaché (Paris) - Dr J.G. Boyazoglu (Agricultural Counsellor) (South African Embassy, 59 Quai D'Orsay, 750077, Paris, France)
Agricultural Attaché (Washington) - Dr A.D. Venter (Agricultural Counsellor) (South African Embassy, 3051 Massachusetts Avenue, Washington D.C. 20008, USA)
Agricultural Attaché (Buenos Aires) - Mr G.J. Carstens (South African Embassy, Avenida

Marcelo T. de Alvear 590-8 Pisco, Buenos Aires, Argentina)
Agricultural Attaché (Canberra) - Mr P.F. du Toit
(South African Embassy, Rhodes Place, Yarrulumba, Canberra ACT 2600, Australia)

(c) RESEARCH INSTITUTES

Soil and Irrigation Research Institute

Belvedere Street, Private Bag X79, Pretoria, 0001

Director - Dr M.C.F. du Plessis

Deputy Director (Chemical Analysis and Soil Survey and Regulatory Services) - Dr P.F. Fuls

Deputy Director (Irrigation Research, Agricultural Meteorology and Agricultural Land Development) - Dr A.D. Nieuwoudt

Assistant Directors:

(Chemical analysis and Regulatory Services) - Dr C.E.G. Schutte;

(Soil Survey) - Dr C.N. MacVicar;

(Irrigation Research) - Mr G.C. Green;

(Agricultural Meteorology) - Dr M.E.L. Buys;

(Agricultural Land Development) - Mr J. Myburgh, Seconded to Agricultural Credit and Land Tenure.

The Institute is responsible for the classification and mapping of the soils of the Republic, as well as for basic research at national level in respect of the physical and chemical characteristics of soils. In addition, soil surveys are undertaken for irrigation projects and the investigation of physical soil characteristics where brack and waterlogging conditions occur. The Institute, on behalf of other Government departments, provincial administrations and other bodies, also undertakes the chemical analysis of soil, water and plant material. Furthermore, the Institute, in terms of Act 36 of 1947, undertakes the inspection and analysis of fertilisers, stock feeds, stock remedies and agricultural remedies. The Institute is responsible for the planning, co-ordination and control of irrigation research carried out by and/or in co-operation with the Regions and Institutes and has also been designated to undertake agricultural evaluations and planning of irrigation areas. Another task of the Institute is the collection, processing and interpretation of meteorological data for agricultural purposes.

Plant Protection Research Institute,

Agriculture Building, Beatrix Street, Private Bag X134, Pretoria, 0001

Director - Dr I.H. Wiese

Deputy Director - Dr J.J. du Toit (Director)

Assistant Director (Entomology/Zoology) - Dr D.P. Annecke

Assistant Director (Combating of Locusts) - Mr I.G. Venter (Chief Professional Officer)

Assistant Director (Phytosanitary Services) - Mr H.P. van Heerden

Assistant Director (Plant Pathology/Microbiology) - Dr B.W. Strydom

The Institute is broadly responsible for advanced research and research at the national level on plant pathology, insect and animal pests and their control. This includes microbiology, taxonomy of fungi, identification of virus diseases, the freeing of propagating material from viruses, honey-bees, insects in stored grain, forest and timber insects, taxonomy of insects and nematodes, economic zoology, toxicology of insecticides and the biological control of insect pests and weeds. The Institute is also responsible for the examination and control of imported plant material and the control of migratory locusts. The Institute uses the research stations and experimental farms at Rietondale (Pretoria), Buffelspoort (Marikana), Fleurbaix and the quarantine station (Stellenbosch), as well as the research units for the control of prickly pear and jointed cactus at Uitenhage and forest pests at Rosebank (Cape Town).

Botanical Research Institute,

Private Bag X101, Pretoria, 0001

Director - Dr B. de Winter

Deputy Director - Dr D.J.B. Killick

Assistant Director - Dr D. Edwards

The Institute undertakes basic research on the flora and vegetation of South Africa with emphasis on taxonomy, morphology, ecology and economic botany. The Institute also controls the Botanical Garden at Brummeria (Pretoria) and herbaria in Durban, Grahamstown, Kimberley, Pretoria, Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute,

Private Bag 11208, Nelspruit, 1200

Director - Dr J.H. Grobler

Deputy Director - Mr A. van Oostrum

Assistant Director - Dr D.L. Milne

The Institute is responsible for country-wide research on all aspects of the citrus and subtropical fruit industry, as well as nuts, tea, coffee and herbs.

The Institute also undertakes research on the research stations and experimental farms Addo (Eastern Cape), Burgers Hall, Citrusdal, East London, Friedenheim, Levubu (Louis Trichardt) Messina, and Rustenburg.

Tobacco Research Institute (Kroondal),

Private Bag, Rustenburg, 0300

Director - Mr J.F. Peens

Deputy Director - Mr H.G. Snyman (Assistant Director)

Assistant Director - Dr M.P. Lamprecht

The Institute is responsible for research, including technological aspects, in the interests of the tobacco industry in all parts of the country. The Institute also undertakes research work on research stations and experimental plots at

Groblersdal, Hartebeespoort (Brits), Nelspruit, Oudtshoorn, Potgietersrus and Stellenbosch.

Horticultural Research Institute (Roodeplaat)

Private Bag X293, Pretoria, 0001

Director - Mr E. Strydom

Deputy Director - Dr J.T. Meynhardt

Assistant Director - Mr T.G. la G. Joubert

The Institute is responsible for all applied and fundamental research and extension on vegetables, cut flowers, ornamental plants and shrubs throughout the whole of South Africa and on deciduous fruit and table grapes in the summer rainfall areas. The Institute controls research stations for vegetables, flowers, decorative plants, table grapes and deciduous fruit research at Roodeplaat in the Transvaal Middleveld and for cherry and deciduous fruit at Emperani, near Ficksburg. In addition the Institute undertakes research on vegetables in the winter rainfall area at Elsenburg, Outeniqua and Lutzville, as well as at Glen in the Orange Free State, at Nelspruit in the Transvaal Lowveld and at Cedara in Natal. Research on indigenous flowers, mainly proteas, is undertaken at Elsenburg and at the Tygerhoek Research Station near Riviersonderend.

Veterinary Research Institute,

Onderstepoort, 0110

Director - Dr K.E. Weiss

Deputy Directors:

(Virus Diseases, Bacterial and Protozoic Diseases, Parasitology and Chemistry) - Dr R.D. Bigalke;

(Pathology, propagation, and Professional Technical Auxiliary Services) - Dr J.D. Smit

Assistant Directors:

(Professional Technical Auxiliary Services) - Dr T.W. Naude;

(Pathology) - Dr J.G. Pienaar;

(Parasitology and Propagation) - Dr C.J. Howell;

(Virus Diseases) - Dr D.W. Verwoerd;

(Bacterial and Protozoic Diseases) - Dr C.M. Cameron;

(Chemistry) - Dr R. Oellermann

The Institute is concerned with research on diseases of stock and wild game (infectious and others, including diseases caused by malnutrition), diagnostics, the preparation of vaccines and diagnostic aids, and the biological evaluation of dips and remedies submitted for registration.

Animal and Dairy Science Research Institute,

Private Bag X2, Irene, 1675

Director - Dr J.H. Hofmeyr

Deputy Director (Livestock Improvement, Animal Physiology and Nutrition and Poultry Science) - Dr P.E. Lombard (Assistant Director)

Deputy Director (Dairy Science) - Dr J.C. Oosthuizen

Assistant Directors:

(Livestock Improvement) - Mr J.S.A.

Landrey;

(Animal Physiology and Nutrition) - Dr J.G.

Cloete;

(Poultry Science) - Mr W.J.C. Viljoen;

(Dairy Science) - Dr J.H. Labuschagne

The Institute, at various centres throughout the country, undertakes at the natural level performance and progeny testing as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen. The Institute has at its disposal a main research station at Irene, undertakes poultry research at Potchefstroom, Elsenburg, the University Experimental Farm at Pretoria and Cedara, and controls random testing of poultry at Irene and Glen as well as pig testing stations at Irene, Cedara and Elsenburg, and bull testing stations at Queenstown and Omatjenne (South West Africa).

Fruit and Fruit Technology Research Institute,

Private Bag X5013, Stellenbosch, 7600

Director - Dr P.G. Marais

Deputy Director - Dr A.J. Heyns (Director)

Assistant Directors:

(Table Grapes, Horticulture, Plant Improvement, Plant Pathology and Entomology) - Dr A.C. Myburgh;

(Chemistry, Cold Storage, Plant Biochemistry, Fruit Processing, Radio Isotopes) - Dr W.J. Pienaar

The Institute is responsible for research on deciduous fruit, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products assigned to it. The Institute further renders a radiation and radio-isotopic service in connection with agricultural problems in the winter rainfall complex.

The Institute controls the research stations and experimental farms at Groot Drakenstein (Bien Donné), Citrusdal, De Doorns, Elgin, Langkloof, Paarl and Robertson.

Oenological and Viticultural Research Institute,

Private Bag, Stellenbosch, 7600

Director - Dr J. de V. Burger

Deputy Director - Mr M.S. le Roux

Assistant Director - Dr J. Deist

The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area. For this purpose the Institute has at its disposal

research stations at Stellenbosch (Nietvoorbij) and Robertson, as well as experimental vineyards at Upington and Lutzville. The Institute controls the historic wine farm Groot Constantia.

(c) DIVISIONS

Division of Soil Protection

Agriculture Building, Beatrix Street, Private Bag X120, Pretoria, 0001

Director - Dr J. Serfontein

Deputy Director (Regulatory Control) - Mr H.S. Niehaus

Assistant Director (Land Subdivision and Weed Control) - Mr J.H. Cloete

Assistant Director (Administrative) - Mr B.J. Dreyer

The Division is responsible for the administration of the Soil Conservation Act (Act no. 76 of 1969), the Weeds Act (Act no. 42 of 1937), and the Subdivision of Agricultural Land Act (Act no. 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Flood Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme and Grass Ley Scheme.

Division of Agricultural Engineering,

Creswell Road, Koedoespoort, Private Bag X515, Silvertown, 0127

Director - Mr J.J. Bruwer

Chief Engineers:

(Regional Services and Soil Conservation) - Mr N.J. van Straaten;

(Research Civil and Irrigation, Testing and Research Mechanical and Utility Services) - Mr C.T. Crosby

Assistant Chief Engineers:

(Regional Engineering Services, Stellenbosch)

- Mr J.F. la G. Matthee;

(Soil Conservation Works, Aliwal Noord) - Mr P.J. Pienaar;

(Research Civil and Irrigation, Pretoria) - Mr I. Scheepers;

(Testing and Research Mechanical, Pretoria) - Mr J. Veenstra

The Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of grain, cold storage and processing of fruit, vegetables and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes. In addition to providing construction, utility, expert extension, regulatory and testing services in the above connection, the Division also undertakes related research.

Division of Agricultural Information,

Agriculture Building, Beatrix Street, Private Bag X 144, Pretoria, 0001

Director - Mr D.B. Marais

Assistant Director (Information Service) - Mr. R.J. van Niekerk, (Deputy Director)

Assistant Director (Publications and Visual Services) - Mr Q. Momberg

The function of the Division is the distribution of agricultural information by mass media. For this purpose use is made of scientific and popular agricultural publications, radio programmes, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Division of Plant and Seed Control

Agriculture Building, Hamilton Street, Private Bag X 179, Pretoria, 0001

Director - Mr J.F. van Wyk

Deputy Director - Mr D.C. Lourens

Assistant Director (Quality Control) - Mr A.J. Cronje

Assistant Director (Inspection and Control Services) - Mr L.J. Grobler

The functions of this Division include the protection of propagation material and the assurance of its quality. The Division administers the Seeds Act (No. 28 of 1961), the Plant Breeders' Rights Act (No. 22 of 1964) and the Agricultural Pests Act (No. 3 of 1973).

Division of Veterinary Services,

Old Transvaal Agricultural Union Building, 281 Struben Street, Private Bag X138, Pretoria, 0001

Director - Dr P.R. Mansvelt

Deputy Directors:

(Regulatory Services) - Dr J.P. van der Merwe (Pretoria);

(Health Services) - Dr J.H.B. Viljoen (Pretoria);

(Veterinary Services - South West Africa) - Dr J.M. Erasmus (Windhoek)

Assistant Directors:

(Notifiable Diseases and Major Disease Eradication Schemes) - Dr A. van Heerden (Pretoria);

(Meat Hygiene and Related Matters) - Dr J.D. Coetzee (Pretoria);

(Animal Health, Non-notifiable Diseases, AI Services and Diagnostic Services) - Dr P. de la Harpe (Pretoria);

(Import and Export Control, Boarder Control, Bantu Veterinary Services and Nagana Control) - Dr G.C. Dent (Pretoria);

(Training, Extension, Liaison and Publications) - Dr P.P. Bosman (Pretoria);

(Highveld Region) - Dr P.P. Hugo (Potchefstroom);

(Natal Region) - Dr W.H.B. Bühr (Pietermaritzburg);

(Eastern Cape and Karoo Region) - Dr C.W.A. Belonje (East London);
 (Eastern Transvaal Region) - Dr L.R. Hurter (Pietersburg);
 (Transvaal Region) - Dr F.W.B. du Casse (Pretoria);
 (Free State Region) - Dr T.A.T. Louw (Bloemfontein);
 (Winter Rainfall Region) - Dr E.O. le Riche (Stellenbosch);
 (SWA North) - Dr C. van Jonker (Windhoek)
 (SWA South) - Dr L.J.F. von Maltitz (Windhoek)
 Assistant Director (Administrative) - Mr M.D. Meyer

The Assistant Directors of the Regions are under the direct control of the Director.

The Division has a specific task in regard to animal health as laid down in the Animal Diseases and Parasites Act, 1956 (Act 13 of 1956) and regulations promulgated in terms thereof.

The Division guards against the introduction of diseases by erecting, patrolling and maintaining game- and cattle-proof fences on the borders of the Republic and South West Africa and by controlling animal imports. For domestic protection regular inspections of all stock are carried out. The promotion of animal health schemes to eradicate certain diseases and animal health in general enjoy high priority.

The Division also has four Regional Veterinary Laboratories throughout the Republic and South West Africa for local investigation of stock losses, problems relating to animal health and suboptimal production and reproduction.

In terms of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), the Division is responsible for the promotion and maintenance of hygiene in cattle slaughterings and handling of meat and animal products, for preventing the transmission of diseases to human beings and animals by disease-infected animals, meat of animal products, for preventing cruelty to animals slaughtered at abattoirs and for controlling the importation of meat.

(e) REGIONAL ORGANISATIONS

The eight Regional Organisations of the Republic, as well as of South West Africa, are responsible within their respective geographical areas, for the planning, development, promotion and application of farming systems based on optimal land utilisation.

Each of these organisations provides an extension service in which the soil conservation effort is integrated and which also covers every aspect of farming. The research services are directed to the collation and releasing of scientific knowledge for the optimal utilisation of the natural agricultural resources. The research personnel are also responsible for specialist

extension work and for supplying training services to the agricultural colleges.

Highveld Region,

Private Bag 804, Potchefstroom, 2520

Director - Dr J.D. Slabber
 Deputy Director (Research) - Dr W.P. Grobbelaar (Assistant Director)
 Assistant Director (Research) - Mr J.D. Basson
 Deputy Director (Extension) - Dr F.J. Kok
 Assistant Director (Extension) - Vacant

Grootfontein College of Agriculture

Research Stations and experimental farms:
 Potchefstroom complex (central research station), Bethlehem and Swartrand (for gousiekte research) at Ventersdorp

Karoo Region,

Grootfontein Agricultural College, Middelburg, 5900

Director - Dr W.J. Hugo
 Deputy Director (Research) - Dr P.W. Roux
 Assistant Director (Research) - Mr J.A.A. Baard
 Deputy Director (Extension) - Mr C.R. Baard
 Assistant Director (Extension) - Dr A.J. Siepker
 Grootfontein College of Agriculture
 Research stations experimental farms:
 Grootfontein, Middelburg, CP (central research station), Carnarvon, Tarka
 Conservation Area, Hales Flats and Jansenville.

Natal Region,

Private Bag 9021, Pietermaritzburg, 3200

Director - Dr P. Hildyard
 Deputy Director (Research) - Dr G.O. Harwin
 Assistant Director (Research) - Dr J.W.C. Mostert
 Deputy Director (Extension) - Mr R.H. Peard
 Assistant Director (Extension) - Dr D.M. Scotney
 Assistant Director (Administrative) - Mr. D.E. Foster

Cedara College of Agriculture

Research stations experimental farms: Cedara (Central Research Institute), Drakensberg Complex, Northern Natal, Kokstad, Makatini, Pongolapoort and Ukulinga

Eastern Cape Region,

P.O. Box 233, Queenstown, 5320

Director - Vacant
 Deputy Director (Research) - Mr J.H. Stapelberg
 Assistant Director (Research) - Mr J.L. van der Walt
 Deputy Director (Extension) - Mr R.W. Nott (Working at the Highveld Region)
 Assistant Director (Extension) - Dr E. le F. Terblanche

Research stations: Dohne (central research station) at Stutterheim, and Bathurst (Port Alfred). A number of experiments are also conducted at East London.

Transvaal Region,

Agrivaal Building, cor. Edmund and Hamilton Streets, Private Bag X180, Pretoria, 0001

Director - Dr D.M. Joubert

Deputy Director (Research) - Vacant

Assistant Director (Research) - Mr J.J. van der Merwe

Deputy Director (Extension) - Mr S.J. Gericke (Assistant Director)

Assistant Director (Extension) - Vacant

Assistant Director (Administrative) - Mr T. Brenkman

Research stations experimental farms: Roodeplaat (central research station), Rietondale, Soutpan (Pretoria), Athole (Amsterdam), Loskop (Groblersdal), Mara (Louis Trichardt), Messina, Nooitgedacht (Ermelo) and Towoomba (Warm Baths).

Free State Region,

Agricultural College, Glen, 9360

Director - Dr S.W. Pienaar

Deputy Director (Research) - Mr W.S. Grobbelaar

Assistant Director (Research) - Dr P.J. Niemann

Deputy Director (Extension) - Vacant

Assistant Director (Extension) - Mr C.W. Oosthuizen

Assistant Director (Administrative) - Mr G.W. Long

Glen College of Agriculture

Research stations and experimental farms: Glen (central research station), Armoedsvlakte (Vryburg), Koopmansfontein (Barkly West), Rietrivier (Herbert), Sandvet, Sydenham, Upington Complex and Vaalharts (Jan Kempdorp)

Winter Rainfall Region,

J.S. Marais Building, Private Bag X5023, Stellenbosch, 7600

Director - Dr J.E. Erasmus

Deputy Director (Research) - Dr P.J.S. Pieterse

Assistant Director (Research) - Mr J.E. van Niekerk

Deputy Director (Extension) - Mr A. Viljoen

Assistant Director (Extension) - Mr D.J. van Z. Smit

Assistant Director (Administrative) - Mr H.C. du Preez

Stellenbosch-Elensburg College of Agriculture
Research stations and experimental farms: Elensburg, Mariendal and Welgevallen (Stellenbosch), Langgewens (Moorreesburg), Nortier (Lambert's Bay), Oudtshoorn, Outeniqua (George), Tygerhoek (Riviersonderend) and the Veld Reserve at Worcester

South West Africa,

Private Bag X13184, Windhoek, 9100

Director - Mr D.J. Louw

Deputy Director (Research) - Mr L. Mostert

Deputy Director (Extension) - Mr J.H. Loubser

Neudam College of Agriculture

Research stations experimental farms: Gellap 'Ost (Keetmanshoop), Hardap (Mariental), Kalahari (Stampriet), Neudam (Windhoek), Omatjenne (Otjivarongo), Sandveld (Gobabis), Sonop (Grootfontein) and Uitkomst (Grootfontein).

(2) FINANCES**(a) REVENUE (REPUBLIC)**

- 1974/75

	R	R	R
1. Rental from houses			199 263,14
2. Interest			18 165,81
3. Recoveries of loans			-
4. Departmental receipts			
<i>Administration and General</i>			
(a) <i>Registration free</i>	107 403,06		
(b) <i>Commission on insurances</i>	7 124,26	114 527,32	
<i>Vaccines</i>		1 459 975,95	
<i>Goods and services</i>		2 098 006,06	
<i>Publications</i>		18 823,14	
5. Miscellaneous revenue			
(a) <i>Refund on voted expenditure</i>	223 823,59		
(b) <i>Sale of State Property</i>	112 971,18		
(c) <i>Unclaimed cash</i>	14 455,64		
(d) <i>Miscellaneous</i>	285 683,28	636 933,69	4 328 266,16
TOTAL			4 545 695,11
6. Interest on Tobacco Research Account			19 864,07
7. Interest on Wine Research Account			1 765,48
8. Interest on Agricultural Research Account			4 762,92
TOTAL REVENUE			4 572 087,58

(b) REVENUE (SWA)
- 1974/75

	R
1. Rental from houses	4 691,59
2. Departmental receipts	
<i>Vaccines</i>	-
<i>Goods and services</i>	386 207,66
<i>Publications</i>	-
3. Miscellaneous revenue	-
TOTAL REVENUE	R390 899,25

(c) EXPENDITURE (REPUBLIC)
- 1974/75

	Vote	Expenditure
	R	R
Salaries and allowances	29 519 000	29 759 054,34
Subsistence and transport	4 082 000	4 064 297,92
Postal services	620 000	605 007,98
Printing	723 000	699 168,63
Miscellaneous	880 000	882 099,30
Plant Protection	200 000	131 326,70
Animal and Dairy Science	710 000	659 338,37
Tobacco	60 000	58 813,27
Soil and Irrigation	102 000	121 938,53
Horticulture	65 000	68 199,21
Citrus and Subtropical Fruit	150 000	148 815,46
Fruit and Fruit Technology	136 000	121 702,16
Botany	60 000	64 604,42
Oenology and Viticulture	99 000	122 959,74
Veterinary	760 000	785 722,10
Veterinary Field Services	1 300 000	1 180 448,43
Plant Pest Control	3 216 000	3 467 977,43
Agricultural Information	106 000	110 869,85
Agricultural Engineering	880 000	776 910,69
Plant and Seed Control	30 000	22 633,49
General maintenance cost (Regions)	735 000	679 204,89
Soil conservation	13 208 000	11 832 880,85
Agricultural Research Stations	571 000	556 447,48
Agricultural Scholarship, etc.	659 000	670 402,45
Minor works	297 000	260 986,16
TOTAL EXPENDITURE	59 150 000	57 851 809,85

(d) EXPENDITURE (SWA)
- 1974/75

	Vote	Expenditure
	R	R
Salaries and allowances	1 755 000	1 782 970,91
Subsistence and transport	596 000	564 402,09
Postal services	20 000	19 538,93
Printing	19 000	10 846,52
Miscellaneous	21 000	19 303,95
Agriculture	147 000	123 864,44
Veterinary	460 000	295 459,85
Soil conservation	3 557 000	3 167 632,39
Agricultural Experiment Farms	192 000	180 974,25
Minor works	11 000	2 091,87
TOTAL EXPENDITURE	R 6 778 000	6 167 085,20

(3) BUILDINGS

(a) Major constructions completed

Stellenbosch: Fruit and Fruit Technology Research Institute - Additions to radio isotope building	R53 657
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(b) Major constructions in hand

Onderstepoort- Veterinary Research Institute - Isolation stables for virus section	R555 000
Ermelo: Nooitgedacht Research Station - Research Building	R420 000
Irene: Animal and Dairy Science Research Institute - Administration Building	R1 050 000

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- B.1 *Klimaatvereistes* - Olivier, O.J.
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H.1 *Opberging en kunsmatige droging van nat koring.*

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B.2 Genetic defects and undesirable characteristics in woolled sheep - Nel, J.E.

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- 130 The cultivation and utilization of planted pastures in the Bushveld and transitional Bushveld areas of the Transvaal Region - Donaldson, C.H. and Kelk, D.M.
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- 140 Veeartsenydiens en Karakoelskaaproduksie in Suidwes-Afrika - Von Maltitz, L.

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(7) NEW LEGISLATION

- Wine, other Fermented Beverages and Spirits Amendment Act, 1974 (Act 75 of 1974).
- Animal Slaughter, Meat and Animal Products Hygiene Amendment Act, 1975 (Act 13 of 1975). Groot Constantia State Estate Control Act, 1975 (Act 24 of 1975).

